UNIVERSITÉ DU QUÉBEC À MONTRÉAL

# ANALYSE DE L'IMPACT DES DÉCÈS, ACCIDENTS ET AUTRES INCIDENTS FERROVIAIRES SUR LES EMPLOYÉS ET PROPOSITION D'UN PROTOCOLE INTÉGRÉ DE SOUTIEN DANS LE MILIEU DE TRAVAIL

THÈSE

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## LISTE DES ABRÉVIATIONS, DES SIGLES ET DES ACRONYMES

CI : Critical Incident

CN : Canadian National

CPR : Canadian Pacific Rail

ÉSPT : État de Stress Post Traumatique

PTSD : Post Traumatic Stress Disorder

RAC : Railway Association of Canada

RFICC : Railway Fatalities, Injuries and Close calls

TC : Transport Canada

TCRC : Teamsters of Canada Railway Conference

## RÉSUMÉ

Ce projet s'inscrit dans une programmation de recherche financée par Transport Canada (2009 – 2014) et portant sur la compréhension et la prévention du suicide par train et de ses conséquences. Les objectifs spécifiques du présent projet sont de décrire les différents types de réactions vécues par les ingénieurs et conducteurs de locomotives après un incident ferroviaire grave (suicides, accidents avec ou sans décès, collisions avec des véhicules ou personnes, out tout autre incident mettant en danger la vie de quelqu'un), de décrire des modèle de développement de ces réactions et de proposer un protocole de prévention et d'intervention pour réduire les risques de développer des réactions traumatiques et pour offrir du soutien aux employés basé sur les meilleures connaissances disponibles.

La méthodologie de l'étude est basée d'une part sur l'analyse de 40 entrevues semi-dirigées dans lesquelles les ingénieurs et conducteurs interrogés ont décrit 122 incidents graves, leurs réactions, l'intervention qu'ils ont reçue, leur satisfaction vis à vis de ces interventions et leurs recommandations pour mieux répondre à leurs besoins après un incident grave. Une codification des incidents décrits dans les entrevues a été effectuée sur un ensemble d'une cinquantaine de variables issues de la recherche et d'une analyse qualitative préliminaire des données. D'autre part, une revue extensive de littérature a permis d'identifier les différentes pratiques de soutien et de gestion d'incident afin de les inclure dans la préparation du protocole de gestion d'incident et de soutien aux employés.

Le projet s'est déroulé en trois phases, faisant l'objet de quatre articles.

La première phase (article un) vise à comprendre les types de réaction que les employés ont eues après les incidents et à modéliser les facteurs de risque et de protection influençant leur développement. Des analyses factorielles ont été effectuées pour identifier des types de mécanismes d'adaptation et des types de réactions n'atteignant pas le seuil d'un diagnostic médical. Dans l'ensemble 80% des incidents sont suivis de réactions négatives plus ou moins ponctuelles (agitation, fonctionnement perturbé, colère, fatigue) et 42% ont été suivis de troubles de santé mentale (État de stress post traumatique, dépression, anxiété, phobie). La modélisation des facteurs de risque et de protection s'est faite à partir des catégories suivantes : réactions immédiate et à très court terme, caractéristiques de l'incident, variables contextuelles, variables liées au milieu de travail et aux relations de travail et type de gestion d'incident. Des analyses de chemin ont permis de comprendre que les facteurs les plus importants dans le développement de diverses réactions sont associés à la gestion d'incident et aux caractéristiques des incidents.

La seconde phase (articles deux et trois) a permis d'analyser les effets observés des incidents ferroviaires graves (article deux) et les pratiques existantes de gestion d'incident et de soutien aux employés ferroviaires (article trois) en incluant les

résultats de la phase un du projet. Malheureusement, très peu de ces pratiques ont été évaluées, même si elles se généralisent dans le réseau ferroviaire et sont intégrées dans les guides de pratiques. Les pratiques les plus communes de soutien après un incident sont le retrait du travail, l'obtention d'un congé jusqu'à trois jours, l'intervention d'un pair aidant formé et le débriefing post incident. Cette analyse constitue, avec les résultats de la phase un, la base du développement de la phase trois du projet.

La troisième phase (article quatre) vise à développer un protocole complet de gestion d'incident et de soutien aux employés après un incident ferroviaire grave, et basé sur les meilleures connaissances disponibles. En plus d'utiliser les données issues de la recherche, nous nous sommes appuyés sur une analyse descriptive des interventions reçues par les ingénieurs et conducteurs interrogés (N=71), ainsi que sur leurs recommandations pour l'amélioration du soutien offert. Cette analyse a montré que les facteurs clé d'un soutien perçu comme adéquat sont le comportement du gestionnaire local, des officiers de la compagnie et de la police, la rigueur d'application des protocoles établis, la présence d'attentes déçues de soutien et soins, la perception de la compétence des cliniciens rencontrés et le niveau de confiance envers l'employeur.

Le protocole proposé comprend des activités à mettre en place avant qu'un incident ne se produise (implantation de protocoles de gestion rigoureux, formation des employés et gestionnaires), des interventions à faire lors de l'incident (adhésion stricte au protocole, empathie, prise de contrôle de la situation, traiter l'employé comme une victime de l'incident), dans les jours qui suivent (informations complémentaires, prise de nouvelles, références à des ressources d'aide), du soutien à plus long terme (planification du retour au travail et de la gestion des réclamations d'assurance, mise à dispositions de ressources cliniques externes).

Mots clés

Suicide, incident ferroviaire grave, train, traumatisme au travail, intervention, prévention, réaction traumatique

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# INTRODUCTION

Depuis qu'il y a des trains, il y a des accidents graves impliquant des personnes du public et des suicides sur les rails. Et depuis qu'il y a des trains, des employés ferroviaires doivent vivre ces évènements, y faire face et continuer à faire leur travail. Au Canada, il y a en moyenne 98 accidents mortels et suicides sur les voies ferrées chaque année, selon les données compilées entre 1998 et 2007 (Mishara & Bardon, 2013a). Les suicides par train représentent 1,5% de tous les suicides au Canada, ce qui est peu comparé à la moyenne des autres pays occidentaux ou ces décès représentent entre 2,7% (en Hongrie) et 14% (en Hollande) des suicides. Le nombre de décès ferroviaires et surtout des suicides est associé à la densité du trafic ferroviaire et de la population (van Houwelingen, Baumert, Kerkhof, Beersma, & Ladwig, 2013), ce qui dans ce contexte, avantage le Canada, qui est assez peu densément peuplé.

Le réseau ferroviaire canadien est un des plus grands du monde, avec plus de 40 000km de voies traversant le pays. Une grande partie de ces voies se trouve en régions très peu peuplées, réduisant ainsi les risques de collision. Les zones les plus à risque sont par contrastes les zones les plus peuplées du pays, en particulier certaines voies de la région de Vancouver, la grande région de Toronto et le corridor entre Toronto et Montréal. L'industrie ferroviaire emploie environ 9000 ingénieurs et conducteurs pouvant se retrouver confrontés à des incidents graves. Cela signifie qu'au cours de leur carrière, les employés ont 65% de chances d'être impliqués dans un décès par train. Il n'existe pas de données sur l'incidence des évènements n'impliquant pas de mort, mais pouvant être tout aussi perturbants.

En général, un train de grande ligne (passager ou marchandise) est conduit par une équipe de deux personnes. L'ingénieur est en charge de la locomotive, il est celui qui applique les freins en cas d'urgence et reste dans la cabine s'il y a une collision afin de maintenir le contact avec le centre de contrôle du trafic ferroviaire. Le conducteur est

chargé de lire la route, d'assurer la sécurité du chargement et il est tenu de descendre évaluer la situation lors d'une collision et de donner les premiers soins si c'est requis.

1. Réactions individuelles et organisationnelles suite à l'incident ferroviaire grave

La façon dont les employés sont impliqués dans ces évènements est particulière dans le domaine des accidents du travail. Les ingénieurs et conducteurs sont à la fois témoins, (du comportement d'autrui), partie prenante (en étant en contrôle du train), premiers répondants (pour vérifier s'il y a des blessés et pour prodiguer les premiers soins) et victimes (potentiellement blessés physiquement et psychologiquement par l'évènement). Ce type d'évènement fait une intrusion soudaine et brutale dans le déroulement d'une journée « normale » de travail, en étant attendu à un certain niveau, puisque tous savent que ça peut arriver, mais en même temps extrêmement surprenant et perturbateur. Il est également impossible à empêcher pour les employés puisque cela peut prendre jusqu'à un kilomètre pour arrêter un train, qui ne peut dévier pour éviter la collision. Le sentiment d'impuissance qui accompagne l'employé peut être très important. Une collision avec un piéton ou un véhicule met la vie d'une personne en danger et la grande majorité des victimes décèdent. Parfois, lors de l'impact, les employés dans la locomotive sont également blessés. Les accidents et suicides par train présentent donc de nombreuses caractéristiques d'évènements potentiellement traumatisants. Le risque est donc élevé que ces employés développent des réactions traumatiques ou des troubles de santé mentale habituellement associés aux évènements traumatisants (Brillon, 2010).

Puisque ces incidents se produisent dans un contexte de travail, il est également important de tenir compte de l'influence que ce contexte peut avoir dans le développement de réactions traumatiques et dans la récupération des employés.

Quelques organisations de sécurité ferroviaire, telles le Rail Safety and Standards Board[1] en Grande Bretagne (Burrows, 2005) ou le Tracksafe Foundation[2] en Australie (Lifeline Foundation, 2012) proposent des recommandations pour offrir un soutien adapté aux employés potentiellement traumatisés. De nombreuses entreprises mettent en place des protocoles de gestion d'incident afin de minimiser la durée d'arrêt du trafic et d'apporter certaines formes de soutien à leurs employés. Par contre ces mesures de soutien n'ont pas suffisamment fait l'objet d'évaluation scientifique d'efficacité. Au Canada, il n'existe pas encore de guide de bonnes pratiques en ce domaine et les transporteurs ont développé des protocoles de soutien variés.

## 2. L'origine du projet de thèse

Ce projet s'inscrit dans un large programme de recherche mené avec le soutien financier de Transport Canada et visant à décrire l'incidence des suicides par train, comparer les caractéristiques des personnes décédées par suicide et par accident sur les rails, identifier des stratégies de prévention du suicide par train adaptées au contexte canadien, évaluer l'impact général et à long terme des décès et autres incidents graves sur les employés ferroviaires et identifier les meilleures stratégies pour prévenir et réduire l'effet négatif de ces incidents.

Le volet « Étude des effets négatifs des incidents et des mesures de prévention du traumatisme » a fait l'objet (1) d'une analyse qualitative préliminaire thématique d'entrevues (Mishara & Bardon, 2013b) et (2) d'une revue préparatoire des mesures de soutien et de soins disponibles (Mishara & Bardon, 2013c. Cette première étape

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[1] RSSB site web : http://www.rssb.co.uk/Pages/Main.aspx

[2] Site web : http://www.tracksafefoundation.com.au/site/suicide_on_rail_research_project.php

du projet a mené à des constats intéressants mais a également soulevé plusieurs questions importantes auxquelles la présente étude cherche à répondre.

Ces constat ont principalement été que :

- L'état de stress post traumatique (ÉSPT) est loin d'être le seul effet négatif des évènements potentiellement traumatiques auxquels sont confrontés les ingénieurs et conducteurs de train (17% des participants à notre étude ont développé un ÉSPT). La plupart des effets négatifs semblent trop faibles pour être décrits dans un diagnostic de trouble mental mais trop importants pour être négligés.
- Il existe des problèmes d'identification, de suivi et de prise en charge des effets négatifs des incidents n'atteignant pas le seuil diagnostic.
- Le règlement médical pour les postes essentiels à la sécurité ferroviaire (Railway Association of Canada, 2010) ne tient pas assez compte de la variété des effets possiblement vécus par les employés ni de la gradation dans l'intensité de ces effets. En évaluant la capacité à travailler par la présence ou l'absence de trouble anxieux ou d'état de stress post traumatique, le règlement dichotomise les symptômes et induit une attitude sans nuance (soit une personne est diagnostiquée et donc incapable de travailler, soit elle est en pleine possession de ses moyens et travaille) et donc les soins apportés (une personne diagnostiquée est soignée par le système de santé, une personne non diagnostiquée ne reçoit aucun soutien spécifique).
- De nombreux effets négatifs vécus semblent liés aux conditions entourant les incidents (contexte et relations de travail, gestion d'incident). Le milieu de travail doit donc être analysé et inclus dans le plan d'intervention pour réduire les effets négatifs chez les employés.

- Plusieurs approches thérapeutiques ont été validées auprès des ingénieurs et conducteurs de train traumatisés, mais il n'existe pas encore de données probantes concernant les pratiques visant à prévenir l'apparition de réactions traumatiques. Une perspective préventive serait probablement pertinente dans le contexte du réseau ferroviaire.

Les questions soulevées par cette étude sont les suivantes :

- Comment s'expliquent et s'articulent les différents symptômes et effets négatifs vécus par les employés après un incident grave? Comment rendre compte de la grande variété d'effets observés entre personnes mais aussi chez une même personne d'un incident à un autre?
- Comment s'articulent les facteurs de protection et de risque identifiés au-delà de leur influence directe perçue?
- Comment ces différents facteurs peuvent-ils influencer le développement de stratégies préventives et de soutien pour réduire l'apparition des effets négatifs observés des incidents graves?
- Quel est le niveau d'efficacité des interventions visant à prévenir les effets négatifs et à apporter du soutien et des soins à ceux qui en ont besoin? Par extension, comment évalue-t-on les besoins des employés après un incident grave?

Le présent projet a pour objectif d'apporter des réponses à certaines de ces questions. Il vise à comprendre la façon dont peuvent se déployer les effets négatifs des incidents graves parmi les travailleurs. En effet, l'analyse détaillée des différents symptômes et réactions vécus est importante dans la perspective des postes essentiels à la sécurité ferroviaire décrits dans le manuel du règlement médical des chemins de fer (Railway Association of Canada, 2010).

Par ailleurs, ce projet vise également à comprendre le rôle des différents facteurs de risque et de protection dans le développement des effets négatifs des incidents graves. Ces facteurs, tels qu'identifiés lors des analyses qualitatives préliminaires effectuées dans le cadre du projet de recherche avec TC, peuvent se combiner pour former des patterns d'influence croisés pouvant augmenter ou diminuer les effets négatifs des incidents. La compréhension du rôle relatif de ces facteurs protecteurs ou aggravants doit permettre de développer une stratégie organisationnelle de prévention, soutien et soins répondant aux spécificités du milieu ferroviaire.

L'atteinte de ces objectifs reposera à la fois sur une analyse approfondie des expériences d'employés ferroviaires canadiens, des recherches effectuées ailleurs et de l'analyse des programmes de soutien actuellement en place dans l'industrie au Canada et ailleurs.

# CHAPITRE I

# PRÉSENTATION GÉNÉRALE DE LA THÈSE ET DES QUATRES ARTICLES LA COMPOSANT

## 1. Évènements faisant l'objet de l'étude

Il est important de définir précisément le type d'évènement inclus dans les analyses proposées dans cette étude. Les études portant sur l'incidence et les effets négatifs des incidents ferroviaires graves ont inclus une variété d'incidents. Les effets de ces incidents peuvent être différents. Certains éléments qualitatifs indiquent que les suicides et les accidents peuvent entrainer des réactions différentes, plus intenses à court terme avec les suicides, avec des émotions négatives plus fortes (Mishara & Bardon, 2013b). Dans certains cas, les incidents durant lesquels une personne est gravement blessée semblent avoir plus d'effets négatifs que les incidents ou les victimes sont décédées sur le coup (Theorell, Leymann, Jodko, & Konarski, 1992), dans d'autres, les décès ont clairement plus d'effets négatifs que les autres types d'incidents (Napper, 1998).

Un certain nombre d'études ont spécifiquement étudié l'effet des suicides sur les conducteurs de train (Abbott et al., 2003; Farmer, Tranah, O'Donnell, & Catalan, 1992; Karlehagen et al., 1993; Malt et al., 1993; Tranah & Farmer, 1994). D'autres ont inclus tous les incidents impliquant une personne entrant en collision avec un train (person under train – PUT) sans distinction d'intention de la part de la victime (Cothereau, 2004; Limosin et al., 2006; Margiotta, 2000; Mehnert, Nanninga, Fauth, & Schäfer, 2012; Theorell et al., 1992; Yum et al., 2006). Quelques études ont analysé l'effet des incidents graves sur les rails ou en contexte de travail, incluant les déraillements et les agressions (Garrison, 2000; Jo, Yim, Kim, Lee, & Park, 2010; Meier, Kennedy, & Hope, 1998; Napper, 1998; Vatshelle & Moen, 1997).

Dans le contexte de la présente étude, nous avons inclus dans l'analyse tous les incidents impliquant l'interaction entre le train et le public, impliquant un véhicule ou non, un décès ou non, un impact ou non. Ce choix est justifié par le fait que lors de nos analyses qualitatives préliminaires (Mishara & Bardon, 2013b), nous avons pu observer l'effet négatif important que pouvaient avoir des évènements qui auraient pu être considérés comme mineurs, tels les « near misses or close calls » (ou la collision n'a pas lieu mais ou l'employé a pensé qu'elle aurait lieu) ou les collisions avec des véhicules dans lesquelles personne n'a été gravement blessé ou tué. Ces incidents, dits mineurs dans le milieu, partagent un certain nombre de caractéristiques avec les incidents mortels ayant fait l'objet du plus grand nombre d'études. Ils sont soudains et imprévisibles, ils présentent un danger pour la vie, l'employé est impuissant à les prévenir, il doit agir comme premier répondant si cela est nécessaire et dans le cas des collisions, il ne sait s'il y a eu des victimes qu'une fois qu'il a vérifié lui-même.

Nous avons donc inclus dans l'étude les accidents mortels, les suicides, les collisions avec piétons ou véhicules sans décès, avec ou sans blessures ainsi que les « close calls » suffisamment marquants pour que la personne s'en souvienne en détails Nous avons exclu les déraillements et les cas d'agression qui nous semblaient deux phénomènes différents. Les déraillements sont des accidents industriels et les agressions sont inexistantes parmi les conducteurs de train que nous avons interrogés et qui ne sont pas en contact direct avec le public.

## 2. Les effets des évènements potentiellement traumatiques

Un évènement potentiellement traumatique peut avoir des conséquences très diverses sur les personnes qui les vivent. La recherche et l'intervention clinique produisent de plus en plus de connaissances très pertinentes pour comprendre ces différents effets (Brillon, 2010, American Psychiatric Association, 2013).

L'état de stress post traumatique (ÉSPT) se retrouve chez environ de 25% à 35% des personnes ayant vécu un évènement potentiellement traumatique (Brillon, 2010). Il est apparu récemment dans les manuels diagnostiques, en 1980 dans le DSM-IV et en 1990 dans le CIM-10 et représente la réaction suivant un incident grave la plus documentée actuellement. Il se diagnostique à partir des six critères très brièvement décrits ici tels qu'ils apparaissent dans le DSM-IV (American Psychiatric Association, 1994): A) exposition à un évènement ou la vie (ou l'intégrité physique) d'une personne était en danger et auquel la personne a réagit avec peur intense, sentiment d'impuissance ou horreur; B) l'évènement est constamment revécu par des souvenirs répétitifs et envahissants, accompagnés de sentiment de détresse, des rêves répétitifs et pénibles, des flashbacks, de la réactivité physiologique lors de l'exposition à des stimulus rappelant l'évènement; C) des comportements d'évitement persistant des stimulus associés au traumatisme et un émoussement généralisé de la réactivité; D) symptômes d'activation neurovégétatives (difficultés de sommeil, irritabilité ou colère, difficultés de concentration, hypervigilance, sursauts); E) la durée des symptômes doit être de plus d'un mois, et à partir de trois mois, l'ÉSPT est considéré comme chronique; F) la détresse est importante et les perturbations sont significatives dans diverses sphères de fonctionnement de la personne. Le DSM-5 (American Psychiatric Association, 2013) a apporté des changements à cette définition, qui ne seront pas discutés ici, puisque leur impact est encore discuté

(Carmassi et al., 2013) et que notre étude et celles sur lesquelles nous nous appuyons ont été faites alors que le DSM-IV était en vigueur.

L'état de stress post traumatique partiel est décrit comme le développement de réactions traumatiques n'atteignant pas le seuil des critères diagnostic de l'ÉSPT, mais ou la personne présente au moins un symptôme de chaque critère (Breslau, Lucia, & Davis, 2004) et reste une classification controversée (Zlotnick, Franklin, & Zimmerman, 2002). L'étude menée par Breslau et al. (2004) a montré que l'ÉSPT partiel induit des détériorations moins importantes que l'ÉSPT complet. Cependant, il important de noter que les personnes ayant un ÉSPT partiel vivent un niveau de détériorations et de limitations significativement plus important que les personnes n'ayant aucun symptômes de stress post traumatique dans leur travail, leur vie sociale et les conflits qu'ils vivent. Une autre étude de grande ampleur menée par Marshall et al. (2001) a montré que l'ÉSPT partiel est associé fortement à d'autres problèmes de santé mentale (dépression, anxiété, idéations suicidaires). Ces résultats encouragent fortement à ne pas percevoir les effets traumatiques comme présents ou absents en fonction du diagnostic, mais à les considérer sur un continuum. Cette approche peut avoir des implications importantes en termes de dépistage et d'intervention.

L'état de stress aigu se distingue de l'ÉSPT par la durée des symptômes (moins d'un mois) et par le rôle plus prévalent donné aux symptômes de dissociation. Il peut précéder un diagnostic d'ÉSPT ou pas. Son incidence a beaucoup moins été étudiée que celle de l'ÉSPT mais les estimations varient grandement d'un groupe de personnes à l'autre, allant de 3% chez les accidentés à 60% chez les femmes victimes d'agression sexuelles (Biggs et al., 2012).

La dépression est commune après un évènement traumatique, soit seule, soit en comorbidité avec l'ÉSPT (Brillon, 2010; Sareen et al., 2007). Par exemple, Marshall et

al. (2001) ont observé que le risque de souffrir de dépression majeure après un évènement traumatique augmente avec le nombre de symptômes d'ÉSPT, mais demeure la plus importante avec ceux souffrant d'ÉSPT partiel (risque 90% plus élevé).

L'anxiété se retrouve également associée aux ÉSPT chez les personnes ayant vécu des évènements traumatiques (Marshall et al., 2001). Les troubles anxieux peuvent s'exprimer sous forme d'attaques de panique ou d'une généralisation de l'anxiété à d'autres situations que celles qui rappellent l'évènement traumatique (Brillon, 2010).

La consommation de substances est également souvent associée aux évènements traumatiques et aux ÉSPT (Sareen et al., 2007), avec les personnes souffrant d'ÉSPT 6.37 fois plus à risque de consommer que les autres. Par ailleurs, jusqu'à la moitié des hommes ayant vécu un évènement traumatique peuvent développer un problème d'abus ou de consommation de substances (Brillon, 2010).

Les comportements suicidaires sont plus présents chez des personnes ayant un ÉSPT (Marshall et al., 2001) et augmentent avec le nombre de symptômes. Les personnes ayant un ÉSPT complet sont trois fois plus à risque d'avoir des idéations suicidaires que les personnes sans ÉSPT (Marshall et al., 2001) et ont 2.35 fois plus de risques de faire une tentative de suicide (Sareen et al., 2007).

3. La prévention des réactions traumatiques

La prévention des réactions traumatiques suite à un évènement grave peut s'articuler en un paradigme réactif ou préventif (Feldner, Monson, & Friedman, 2007; Skeffington, Rees, & Kane, 2013). L'approche réactive vise à dépister la présence d'ÉSPT chez les personnes ayant vécu des évènements graves et à offrir le traitement approprié. Il semble qu'il y ait un consensus sur le besoin de développer des connaissances plus rigoureuses sur l'efficacité de la plupart de ces stratégies de soin

(Bomyea & Lang, 2012). Les traitements les plus souvent cités et évalués semblent être :

- Les thérapies cognitives comportementales sont très largement utilisées dans le traitement d'un nombre important de troubles de santé mentale. Leur utilisation auprès des personnes souffrant d'un ÉSPT est basée sur les modèles cognitifs de l'ÉSPT (Kalantzi-Azizi & Karademas, 2005). Ces modèles expliquent le développement de symptômes par la perception d'une menace continue causée en grande partie par des processus d'évaluation cognitive, des souvenirs verbaux et situationnels mal intégrés et des mécanismes d'adaptations inadéquats (Kalantzi-Azizi & Karademas, 2005). Ces approches cognitivo-comportementales ont été validées avec succès auprès de divers types de personnes traumatisées (Bisson et al., 2007; A. G. Harvey, Bryant, & Tarrier, 2003).
- La désensibilisation et retraitement par les mouvements oculaires (ou Eye Movement Desensitisation and Reprocessing – EMDR) est un traitement bref développé par Shapiro and Maxfield (2002) pour permettre à une personne ayant vécu un évènement grave de dissocier la charge émotive des souvenirs de l'évènement. Plusieurs études empiriques, regroupées en revues de littératures ont montré que le EMDR est efficace pour traiter les symptômes de l'ÉSPT (Bisson et al., 2007; Shapiro, 2012).

Un ensemble de traitements émergents peuvent également être prometteurs pour réduire les symptômes d'ÉSPT, même s'il n'existe pas encore assez de données empiriques pour appuyer leur validité, dont par exemple :

- Les thérapies interpersonnelles (utilisées en premier avec la dépression) mettent l'accent sur les effets des évènements traumatiques sur les relations interpersonnelles dans le but d'améliorer le fonctionnement social et de

réduire les symptômes d'ÉSPT. Le prémisse de son utilisation est que les difficultés liées aux ÉSPT se manifestent en grande partie dans la sphère sociale de la personne, avec du détachement, de l'isolement ou du retrait social, de l'irritabilité, de la colère ou encore de la perte de confiance (Cukor, Spitalnick, Difede, Rizzo, & Rothbaum, 2009; Markowitz, 2010).

- Les thérapies psychodynamiques cherchent à aider la personne à comprendre et diminuer l'intensité de ses conflits intérieurs et ses relations au monde environnant après un évènement traumatique (Horowitz et al., 1997).
- Les thérapies basées sur l'acceptation et l'engagement, comme la thérapie dialectique comportementale ou la pleine conscience (mindfulness) ont pour objectif de permettre de modifier la relation entre la personne et l'expérience psychologique qu'elle a vécue, plutôt que de réduire les symptômes (Bomyea & Lang, 2012). Dans le contexte de l'ÉSPT, ce type de thérapies met l'accent sur la capacité d'allouer son attention et ses ressources à ce qui se produit dans le moment présent, à accepter et intégrer l'évènement plutôt que de porter un jugement ou tenter de contrôler l'incontrôlable, à diminuer l'évitement et améliorer la capacité de changer ses comportements en fonction de ses valeurs (Bomyea & Lang, 2012).
- L'activation comportementale vise à engager la personne dans des activités physiques et sociales afin de réduire son retrait social et les comportements d'évitement (Cukor et al., 2009).
- Les thérapies familiales visent à diminuer les conséquences d'un évènement traumatique et de l'ÉSPT d'une personne sur la cellule familiale (Cukor et al., 2009)

Dans une autre perspective, l'approche préventive vise à mettre en place les conditions pouvant prévenir l'apparition de troubles de santé mentale (en particulier

l'ÉSPT) et à consolider les capacités de résilience des personnes à risque de développer des réactions traumatiques suite à un évènement grave (Skeffington et al., 2013). Cette approche de prévention est celle prônée par l'organisation mondiale de la santé depuis une dizaine d'années (World Health Organization, 2004) et a fait l'objet de moins de développements scientifiques que les approches de traitement (Feldner et al., 2007). Elle vise à identifier les facteurs qui favorisent ou empêchent une récupération saine après un évènement traumatique. Ces facteurs sont essentiellement intra-individuels (apprentissage de la peur qui demeure active, même en l'absence de stimulus dangereux; difficulté de gestion de l'information, qui rend la personne incapable de « faire du sens » autour de l'évènement; problèmes de mémoire, qui rendent les souvenirs morcelés et facilement accessibles). Certains facteurs environnementaux peuvent les influencer. Les facteurs prédisposants favorisent le développement des vulnérabilités intra-individuelles et les facteurs précipitants interagissent avec les facteurs prédisposants et les vulnérabilités individuelles pour déclencher des dysfonctions lors d'évènements particuliers. Ce sont ces facteurs prédisposants et les processus d'acquisition des vulnérabilités qui sont ciblés par les programmes de prévention (Feldner et al., 2007).

Les programmes visant à développer la capacité de récupération et de résilience sont mis en place avant qu'un évènement potentiellement traumatique ne se produise, auprès de personnes à risque d'être exposées. Il s'agit le plus souvent de programmes visant à développer les compétences des personnes dans le but d'améliorer leur fonctionnement ou leur bien-être (Skeffington et al., 2013). Ces programmes de prévention peuvent être basés sur différents concepts et processus :

- Les programmes de psychoéducation, visant à préparer les personnes à vivre des évènements potentiellement traumatisants, ont été expérimentés auprès d'intervenants d'urgence (Benedek & Ritchie, 2006) et de militaires (Sharpley,

Fear, Greenberg, Jones, & Wessely, 2008) sans parvenir à montrer d'effets significatifs de réduction des ÉSPT.

- Les programmes de développement de compétences, visant à développer les compétences des personnes pour faire face à des évènements graves, ont été expérimentés entre autre auprès de militaires (Deahl et al., 2000) et de policiers (Sijaric-Voloder & Capin, 2008) avec des effets potentiellement prometteurs, mais sans preuves empiriques d'effet de réduction des ÉSPT.
- Les programmes de simulation visant à effectuer une désensibilisation au stress ont été essayés avec des policiers (Arnetz, Nevedal, Lumley, Backman, & Lublin, 2008), sans preuves que la réduction de stress observée lors des simulations se reproduise en situation réelle.

Parallèlement, les stratégies individuelles de prévention des réactions traumatiques, appliquées une fois que l'évènement s'est produit visent à réduire l'incidence des symptômes. On retrouve dans cette famille d'interventions préventives, des interventions visant les symptômes ou les processus intra-individuels d'apprentissage, de gestion d'information ou de mémorisation (Feldner et al., 2007). Par exemple :

- Le débriefing psychologique basé sur les travaux de Mitchell (1993). Il vise les personnes à risque de développer des réactions traumatiques après un évènement. Cette intervention vise à permettre à la personne d'exprimer verbalement les émotions et cognitions liées à l'évènement et de mobiliser ses ressources pour y faire face. Elle reste controversée, avec des résultats contradictoires, montrant que dans la majorité des cas, le debriefing ne permet pas de diminuer l'incidence d'ÉSPT (Flannery & Mitchell, 2000).
- Les interventions psychologiques brèves visant des facteurs de risque particuliers ont pour objectifs de diminuer le risque de développer des

symptômes. Une grande variété d'interventions tombe dans cette catégorie pour lesquelles il n'existe que très peu de données sur leur efficacité (Forneris et al., 2013). On peut citer ici les thérapies cognitivo-comportementales, l'hypnose, les thérapies cognitives, les thérapies par exposition, la psychoéducation, le self help ou encore le supportive counceling (Forneris et al., 2013). Par exemple, des activités de psychoéducation ont été testées pour aider des victimes de violence sexuelle (Resnick, Acierno, Holmes, Kilpatrick, & Jager, 1999). Des interventions visant à favoriser l'intégration des souvenirs d'un évènement ont été essayées avec des victimes d'accidents (Gidron et al., 2001). Ces interventions se produisent le plus rapidement possible après l'évènement et semblent montrer des effets prometteurs (Gidron et al., 2001; Resnick et al., 1999).

- Une adaptation des services de soutien et soins au niveau de symptômes et développée en partenariat avec les personnes exposées à des évènements graves permet une flexibilité de soins afin de faire face à une évolution possible des problèmes de la personne. Elle permet également de renforcer le sentiment de contrôle et de pouvoir (Zatzick et al., 2004). Cette approche n'a été testée qu'auprès d'accidentés de la route et a montré des effets prometteurs (Zatzick et al., 2004).
- Le traitement de l'état de stress aigu. Cette approche permet de réduire le risque de chronicisation des symptômes en un ÉSPT. Il s'agit de prévention indiquée selon la classification de l'OMS.
- Le renforcement du soutien social semble une composante de plus en plus reconnue de la prévention des réactions traumatiques, grâce au rôle modérateur du stress qu'il joue (Guay et al., 2011; Guay, Billette, & Marchand, 2002). Les interventions visant à renforcer le soutien positif, inclure les

proches et faciliter la gestion au quotidien de l'évènement doivent être testées mais peuvent être prometteuses (Bousquet Des Groseilliers, Marchand, & Brunet, 2006).

La plupart de ces études et interventions ciblent la prévention ou la réduction des ÉSPT, qui constituent environ 10% des réactions possibles après un évènement grave (Breslau, 2009). Elles n'ont pas pour objectifs premiers de diminuer les effets négatifs non diagnostiqués.

Cette limite est renforcée par le fait qu'il peut être parfois difficile d'identifier les personnes à risque de développer un ÉSPT afin de leur proposer une intervention préventive. Des recherches doivent être menées dans ce domaine afin d'améliorer la capacité d'identification des personnes à risque (Feldner et al., 2007). Il serait probablement très porteur d'élargir l'analyse des facteurs de risque à des facteurs associés à des niveaux écologiques différents (micro-, exo- et macro-systémiques), incluant les milieux de vie et de travail, les interactions avec les divers intervenants de crise et de gestion d'évènements, les proches, les structures de soin ou encore les valeurs dominantes des groupes auxquels appartiennent les personnes à risque.

4. Le traumatisme en milieu de travail

Les évènements potentiellement traumatisants en milieu de travail peuvent être étudiés sous différents aspects : (1) le rôle du milieu de travail (organisation du travail, statut professionnel, appartenance organisationnelle) dans le développement du type et de l'ampleur des réactions traumatiques, (2) le rôle du milieu de travail dans la récupération après l'incident (contexte de récupération) pour accélérer ou ralentir les effets du traitement.

Le contexte organisationnel dans lequel se produit l'incident ayant un rôle important à jouer dans le développement des réactions post-évènement, il est donc important

que l'intervention tienne compte de ces facteurs organisationnels afin de réduire efficacement les différents symptômes vécus (Paton, Smith, & Stephens, 1998). Cette prise en compte permet également de travailler en amont des incidents afin de soutenir au niveau organisationnel le développement de stratégies d'adaptation pouvant diminuer la réactivité des personnes lorsqu'un incident se produit. Le milieu de travail peut ainsi devenir un élément clé de la prévention et de la gestion du traumatisme chez les employés à travers un changement organisationnel, une redéfinition des tâches, la formation ou le développement des leaders (Paton & Burke, 2007; Paton et al., 1998).

Selon McFarlane & Bryant (2007), les modèles du risque de stress post traumatique en milieu de travail doivent tenir compte des facteurs pré-incidents (le plus souvent des prédispositions individuelles), liés à l'incident lui-même (effet d'accumulation, identification avec les victimes, intensité de l'évènement) et post-incidents (soutien social, stresseurs subséquents). Il est intéressant de noter que les facteurs identifiés à chaque niveau sont associés en général à la personne, ses mécanismes d'adaptation ou son entourage. Très peu de facteurs liés au milieu de travail lui-même sont considérés.

Le milieu de travail peut agir à plusieurs niveaux. D'un côté, il peut gérer les expositions répétées aux incidents dans les milieux à risque comme les services d'urgence en effectuant des évaluations systématiques du risque d'accumulation et en organisant le travail pour réduire ce risque (McFarlane & Bryant, 2007). Le milieu de travail peut ainsi construire une résilience organisationnelle face aux évènements traumatisants (Friery, 2012; Turnbull, Lwin, & McNab, 2012).

Il peut également gérer les expositions aux évènements lorsqu'ils se produisent en ayant des protocoles de gestion d'incident rigoureux, basés sur la formation des gestionnaires à détecter les personnes à risque, sur le développement du soutien par

les pairs, sur l'utilisation d'instruments d'évaluation efficace des risques et sur une offre de soutien psychologique par l'employeur (McFarlane & Bryant, 2007). Lorsqu'un traumatisme se produit, dans un milieu de travail, les politiques et procédures en place déterminent la réponse et la façon dont les besoins des personnes impliquées vont être pris en compte (J. Rick & Briner, 2012) La réponse organisationnelle est donc très importante pour limiter l'impact des évènements traumatisants et elle doit se fonder sur de bonnes pratiques de gestion. Les recommandations (NICE, 2009) et protocoles d'intervention évalués dans des milieux de travail considérés comme à risque (armée, premiers répondants) permettent d'identifier les composantes clés de ces politiques organisationnelles (J. Rick & Briner, 2012).

Les gestionnaires sont décrits comme ayant un rôle central à jouer dans ces protocoles et politiques organisationnels. Ils sont au cœur de la gestion d'incident et sont ceux qui peuvent amener un sentiment de sécurité et de calme. Ils donnent le sentiment d'efficacité individuelle et collective, favorisent la connexion entre les gens, apportent l'espoir et favorisent l'accès à l'aide (Walter, Hall, & Hobfoll, 2008).

Dans de nombreux cas, le retour au travail fait partie intégrante du processus de guérison (Kinder & Rick, 2012) et limiter ou retarder un retour à cause de la présence résiduelle de certains symptômes peut engendrer plus de difficultés d'adaptation à long terme chez un employé qui se sent prêt. Cet enjeu de l'absence ou présence de certains symptômes peut avoir une influence majeure dans le processus de guérison des employés ferroviaires. Le fait qu'ils sont soumis aux régulations associées aux emplois importants pour la sécurité implique qu'ils doivent être asymptomatiques pendant plusieurs mois avant de revenir travailler. Ils peuvent donc rester en retrait de leur emploi plus longtemps qu'ils en auraient besoin, ressentir de la frustration à

ne pas pouvoir travailler et de l'impuissance face à leur processus de guérison (Mishara & Bardon, 2013b).

5. La collaboration avec les différents acteurs et milieux industriels

L'approche de psychologie communautaire implique qu'une place importante soit faite aux partenariats avec les milieux de pratique dans le développement des projets et des programmes d'intervention, dans ce cas, le milieu de l'industrie ferroviaire au Canada. Pour répondre à ce principe, ce projet se déroule dans un contexte de collaboration avec des partenaires de l'industrie ferroviaire. Les rapports préliminaires du projet ont été remis aux organisations membres du comité aviseur et les premières recommandations faites ont été discutées avec différents acteurs du milieu (Teamsters of Canada Railway Conference - TCRC et VIA Rail) avant d'être intégrées dans une proposition de protocole de soutien aux employés.

De plus, il est important de prendre note que la santé des conducteurs et ingénieurs ferroviaires au Canada est gérée par le règlement médical (Railway Association of Canada, 2010). En effet, ces employés détiennent des postes importants pour la sécurité et doivent présenter un bon niveau de santé physique et mentale et une absence de symptômes ou de traitement qui puisse mettre en jeu leur capacité de concentration et leur capacité de prendre des décisions rapidement. Le règlement définit donc les conditions dans lesquelles un employé peut travailler, prescrit les conditions et les délais de retour au travail après un diagnostic médical suite à un incident critique. Il peut avoir une influence importante sur la manière dont les employés et gestionnaires agissent après un incident. Le règlement médical peut également devenir un levier important de changement de pratiques de gestion d'incidents.

## 6. Objectifs et hypothèses

L'objectif principal du projet est de comprendre la variété des effets que les évènements potentiellement traumatiques peuvent avoir sur les employés de train au Canada ainsi que de proposer un ensemble de mesures préventives adaptées au contexte de l'industrie ferroviaire canadienne et fondées sur les meilleures connaissances disponibles.

Nous faisons l'hypothèse que les réactions des employés à un évènement ferroviaire potentiellement traumatisant peuvent être diagnostiquables (trouble de santé mentale) ou non diagnosticable (symptômes variés ou diffus, ponctuels ou sous le seuil diagnostic pour un trouble de santé mentale) et que ces différents niveaux de réactions peuvent apparaître en comorbidité, avoir des sources et des conséquences différentes pour les personnes qui les vivent.

Nous voulons comprendre la façon dont les facteurs de risque et de protection se combinent entre eux et influencent le développement de différents effets diagnostiqués et non diagnostiqués. Nous faisons l'hypothèse que certains facteurs de risque et de protection liés au contexte de travail peuvent influencer de façon significative l'apparition et la durée des effets non diagnostiqués et des effets diagnostiqués après un évènement potentiellement traumatisant.

Nous voulons développer un ensemble de recommandations pour un protocole de soutien au sein des entreprises visant à réduire l'incidence des réactions traumatiques suite à un incident grave. Ce troisième objectif a été développé suite à l'analyse des facteurs de risque et protection liés aux incidents, à la gestion d'incident et au milieu de travail. Nous partons du postulat que, en l'absence de données évaluatives empiriques fiables, nous pouvons nous baser sur les recommandations des guides de l'industrie et l'expérience des employés ferroviaires afin de développer des protocoles de gestion d'incident et de soutien pour réduire les effets négatifs des

incidents graves. Nous faisons donc l'hypothèse que des activités de prévention et de soutien proximal visant à réduire l'incidence des facteurs de risque et à augmenter l'incidence des facteurs de protection liés au travail (donc en renforçant le rôle potentiellement protecteur du milieu de travail) peuvent diminuer le nombre et l'ampleur des effets négatifs vécus suite à un incident grave.

7. Structure de l'étude et des articles

Cette étude se divise en quatre articles complémentaires abordant chacun une dimension du projet.

L'article un comprend deux volets. Le premier constitue l'analyse de l'ampleur et de la variété des effets des incidents telles qu'observées chez les travailleurs de l'industrie ferroviaire canadienne. Le second est la modélisation des facteurs de risque et de protection pouvant expliquer l'apparition de ces symptômes et effets négatifs. Ce premier article constitue la base théorique (théorie du problème) à partir de laquelle seront construites les recommandations pour un protocole de soutien intégré au milieu de travail.

L'article deux consiste en une revue de littérature sur les études portant sur l'impact des incidents graves sur les employés ferroviaires ainsi que les facteurs de risque identifiés. Le fait d'effectuer cette revue critique de la littérature dans un deuxième article nous permet d'inclure l'analyse des effets négatifs les résultats de notre étude et donc de les comparer avec ceux obtenus dans les recherches antérieures.

L'article trois fait une analyse critique des différentes activités de soutien offertes aux employés ferroviaires après un incident grave, de leur validité empirique et de leur niveau d'application dans l'industrie.

L'article quatre constitue d'abord une analyse qualitative des activités de prévention, de soutien et de soins auxquelles ont été exposés les employés ferroviaires canadiens

et le niveau de satisfaction associé. En associant les résultats de cette analyse aux données issues de la recherche sur les meilleures pratiques de prévention, soutien et soins (article trois) et sur l'analyse des facteurs de risque (articles un et deux), nous proposons ensuite un protocole intégré au milieu de travail de prévention, soutien et soins basé sur la prémisse qu'un ensemble de stratégies inscrites dans les processus de travail et organisationnels présente des chances de succès (utilisation accrue par les employés et effets positifs importants).

Une conclusion synthétise les liens entre les différents résultats décrits dans les quatre articles et les réponses aux questions initiales du projet.

# CHAPITRE II

# ARTICLE UN

# MODELS FOR UNDERSTANDING HE IMPACT OF RAILWAY FATALITIES, INJURIES AND CLOSE CALLS ON RAILWAY WORKERS AND THE ROLE OF PROTECTIVE AND RISK FACTORS

*Cet article a été soumis à la revue Journal of Occupational Health Psychology*

## 1. Résumé

Ce chapitre constitue le premier article de la thèse et présente une modélisation des facteurs pouvant influencer l'effet des incidents ferroviaires graves (accidents avec ou sans décès, suicides, blessures et autres incidents mettant la vie de personnes en danger) sur les conducteurs et ingénieurs de locomotive.

Un total de 40 employés ont été interrogés de façon rétrospective au sujet des incidents graves qu'ils ont vécus dans leurs carrières. Une base de données composée de 122 évènements a été composée et soumise à des analyses statistiques.

Nos résultats montrent que les effets négatifs de ces incidents graves peuvent se répartir entre des réactions non diagnostiquées (agitation, fonctionnement perturbé, colère, fatigue), qui se retrouvent à plus ou moins long terme après 80% des incidents et des problèmes de santé mentale (ÉSPT, dépression, anxiété, phobie) présents chez 42% des personnes après un incident. Ces différentes réactions peuvent également avoir des durées très variables selon les cas et se présentent souvent en comorbidité. Les facteurs de risque et de protection associés avec les effets post-incident ont été classées en cinq catégories : réactions immédiate et à très court terme, caractéristiques de l'incident, variables contextuelles, variables liées au milieu de travail et aux relations de travail et type de gestion d'incident.

Des analyses de chemin ont montré que les facteurs liés aux pratiques de gestion d'incident et aux caractéristiques des incidents sont les plus fortement associés au développement d'effets négatifs et de réactions traumatiques.

2. Abstract

This article presents a model for understanding the risk and protective factors affecting the impact of railway fatalities, injuries and close calls (RFICC) on train drivers based upon the results from a retrospective study. We analysed 122 events described by 40 railway crew members. The negative effect of these incidents includes non-diagnosed reactions (agitation, disturbed functioning, anger, fatigue) and mental health problems (post traumatic disorder, depression, anxiety and phobia), and the duration of these effects vary greatly. Risk and protective factors associated with post incident reactions can be classified in terms of on-site interventions, incident characteristics, contextual variables, work related factors and the nature of the incident management. We propose pathway analysis models of variables associated with reactions. Diagnosed effects such as PTSD are present in railway workers (17%) but non diagnosed effects (including "sub-threshold" trauma reactions) are present after more than 80% of RFICC. Work related factors, such as incident management practices, and characteristics of the incident, such as the perceived vulnerability of the victim, seeing the eyes or face of the victim and the nature of the incident (fatality, injury, accident or suicide) are strongly associated with the development of post incident effects.

3. Key word

Railway fatalities, traumatic reaction, workplace trauma, risk and protective factors, impact of event

## 4. Introduction

Train crew members, in the course of their career are likely to be involved in major incidents implicating pedestrians or vehicles during which there can be injuries and loss of life. A study of US train drivers found that 75% experienced at least one person under train (PUT) incident in their career (Margiotta, 2000). In a retrospective study (Vatshelle & Moen, 1997), 48.7% of Norway train drivers reported experiencing a major incident.

Train crew often experience a high level of stress in their daily work (Barnes, 1992a, 1992b; Garrison, 2000; Napper, 1998), mainly caused by working shifts that affect sleep and rest patterns, violence towards personnel by passengers, risk of traumatic events (recurrent near misses, suicides and accidents), noise and vibrations from the engine, low feelings of control and low levels of autonomy. These working conditions may induce a high baseline stress level that may be expressed in trait anxiety, anxious reactive personality, fatigue, proneness to stress reactions and alcohol consumption. Thus, when a RFICC occurs, the pre-existing high stress induced by work or personal characteristics or events may intensify their negative reactions.

Research on the impact of RFICC has focussed upon train drivers and incidents where the train hit a person, sometimes referred to as a Person Under Train (PUT). Sometimes only fatalities, classified as suicides or accidents, have been studied. However, other studies also included incidents where no impact with a person or vehicle occurred, but where there appeared to be imminent danger of an impact, generally referred to as "near misses" or "close calls".

### 4.1. Immediate Reactions

The immediate impact of a railway RFICC has been described as intense acute psycho-physiological stress reactions, such as rapid heartbeat, tremor, restlessness or shaking (Malt et al., 1993); shock, numbness and horror, (Abbott et al., 2003); as well as anger at being drawn into a situation the crew did not choose and at poor handling by management and emergency services (Abbott et al., 2003). These immediate reactions may or may not lead to further symptoms and difficulties.

### 4.2. Traumatic Reactions

Most of the research has focussed upon the development in the week following the event of Acute Stress Disorder (ASD), and in the month that follows of Post Traumatic Stress Disorder (PTSD). The incidence of these traumatic reactions varied from 4% (Cothereau, 2004; Limosin et al., 2006), 11.4% (Margiotta, 2000) to 16.3% (Farmer et al., 1992). However, it is important to note that all these studies concerned people whose symptoms were severe enough to warrant a diagnosis. However, many crew members did not have enough symptoms to be diagnosed with PTSD, but they still had several PTSD symptoms. For example, Farmer and colleagues (1992) found that 37% of drivers had six PTSD symptoms or more, one month after the incident.

### 4.3. Other Diagnosable Reactions

Beside traumatic reactions, depression, anxiety and phobia has been observed in crew members after a RFICC in 27% of cases (Farmer et al., 1992) and in 31% of cases by Margiotta (2000). However, it seemed that when depressive symptoms were apparent immediately after the incident, they receded quickly (Limosin et al., 2006; Margiotta, 2000).

### 4.4. Non Diagnosed Effects

Non diagnosed effects constituted a large portion of the negative effects of RFICC. The most frequently observed effects were sleep disturbance (Abbott et al., 2003; Malt et al., 1993; Theorell et al., 1992; Theorell, Leymann, Jodko, Konarski, & Norbeck, 1994), Intrusion and Avoidance as measured on the Impact of Event Scale (IES) (Briem, de Lima, & Siotis, 2007; Karlehagen et al., 1993; Malt et al., 1993; Meier et al., 1998; Napper, 1998; Vatshelle & Moen, 1997), flashbacks (Abbott et al., 2003; Briem et al., 2007; Malt et al., 1993; Margiotta, 2000), distress associated with the event but also with proceedings following the event such as reports or trials (Margiotta, 2000), and physical health problems, such as musculoskeletal pains and gastrointestinal troubles (Vatshelle & Moen, 1997). People also experienced anger, blaming oneself, the employer or God for what happened, withdrawal, (Margiotta, 2000), intrusive memories (Abbott et al., 2003) and hyper vigilance (Briem et al., 2007). Stress levels following involvement in a RFICC were higher than in the general population (Briem et al., 2007; Margiotta, 2000; Napper, 1998; Vatshelle & Moen, 1997) and symptoms could reappear when crew members worked on the same route (Abbott et al., 2003; Margiotta, 2000). Crew members may also have felt less socially engaged (Briem et al., 2007; Limosin et al., 2006; Margiotta, 2000). Although these symptoms did not meet criteria for a diagnosis of PTSD, they were frequent and pervasive and have been described by Briem et al. (2007) as "long term, low key PTSD".

### 4.5. Duration of Effects

Several studies have analysed the way negative effects evolve over time and their results varied widely. The most severe symptoms seemed to occur within the first few days and weeks after the incident (Limosin et al., 2006; Margiotta, 2000). After one month, a significant minority of drivers could still be off work, from 16.3% (Farmer et al., 1992) to 38% (Theorell et al., 1992). However, other studies showed that after one month, symptoms tended to decrease, with stress levels remaining high for only 7% of crew members (Karlehagen et al., 1993). Sleep disturbance also decreased within a few weeks after the incident (Abbott et al., 2003). After three months, most effects had receded and drivers generally returned to "normal functioning" (Limosin et al., 2006; Tranah, O'Donnell, Farmer, & Catalan, 1995).

In most cases, studies of PUT events found that the reduction in symptoms continued until one year after the incident, when symptoms generally returned to the levels observed in colleagues who had not had a PUT incident, no matter whether the incident was an accident, a suicide, and with or without a fatality (Cothereau, De Beaurepaire, & Payan, 2004; Karlehagen et al., 1993; Theorell et al., 1992). However, a minority of drivers continued to have symptoms that had an important impact on their lives. For example, 2.9% of drivers were still taking psychotropic drugs a year after the incident (Limosin et al., 2006), drivers involved in PUTs took more time off (on average 9.17 days) than their colleagues (4.60 days) during the following the year (Limosin et al., 2006) and 4.9% still experienced health problems (Karlehagen et al., 1993). Although acute symptoms and short term reactions tended to diminish in the following years, there also appeared to be long term impacts on physical and psychological health that would need further investigation.

### 4.6. Cumulative Effects

Cumulative effect appeared when the negative effects of several events added up and the duration or intensity of reactions to subsequent events was heightened. Several studies have noted the occurrence of this cumulative effect in their samples (Austin & Drummond, 1986; Karlehagen et al., 1993; Vatshelle & Moen, 1997; Yum et al., 2006). However, cumulative effect did not develop in all crew members and could take several forms that are yet to be explored (Briem et al., 2007; Farmer et al., 1992; Margiotta, 2000).

### 4.7. Risk and Protective Factors

Several of the research investigations identified factors that may increase or mitigate the trauma reactions. Personal characteristics, such as age, family situation, level of spirituality or seniority did not predict the intensity of stress reactions after a PUT (Margiotta, 2000). However, social support provided by family members somewhat reduced the intensity of the stress reaction (Abbott et al., 2003). Suppression of emotions proved to be a poor coping strategy for train crews, since it prevented the drivers from dealing with the emotional toll of the event and could induce long term poor coping strategies, such as binge drinking, using medication or drugs (Abbott et al., 2003). Resilience and humour, adequate coping strategies such as talking, using support, counselling and peer support reduced the effect of PUT incidents (Abbott et al., 2003). In some cases, having previous PUTs also helped reduce the negative effects of subsequent events when employees could draw from these past experiences to better understand what was happening now (Abbott et al., 2003). Briem et al. (2007) found that the impact of the fatality was influenced by the probability that an incident may occur, the predictability of the incident, the

understanding drivers had of what happened, cognitive coping and interpersonal trust.

Very few studies distinguished between the impact of suicides and the impact of accidental deaths. Briem et al.(2007) found that suicides were usually less difficult to understand because one could rationalize that the victim intentionally caused the fatality. However, this ability to explain or understand the incident did not prevent most drivers from feeling guilt and anxiety.

In general, when compared with other types of fatalities, railway deaths were different in several aspects. Driving a train is one of the rare situations where workers can injure or kill somebody while carrying out their work (Austin & Drummond, 1986; Tranah et al., 1995). Other workers are rarely in the situation of train drivers who can feel that they are contributing to somebody else's death (Austin & Drummond, 1986; Tranah et al., 1995; Vatshelle & Moen, 1997). Near misses constantly remind drivers of the possibility of a fatality, especially when involving maintenance crews (Austin & Drummond, 1986). Incidents occur suddenly, without warning and at a high speed (Malt et al., 1993; Vatshelle & Moen, 1997), which makes them even more shocking. Since trains cannot stop quickly, drivers have no possibility of avoiding a collision; they are in a situation of extreme helplessness (Malt et al., 1993; Theorell et al., 1992; Vatshelle & Moen, 1997). Also, train drivers may see the victim alive prior to impact and make eye contact, which is a recognised source of trauma (Malt et al., 1993).

For all the above reasons, train fatalities have specificities which make their effect upon workers difficult to compare with other types of work related critical incidents and fatalities. Other professions where deaths sometimes are experienced, such as police, firemen and other emergency workers, have more control over the situations they encounter than train drivers and they usually know beforehand that there is a

risk of an injury or death occurring or having occurred, making the event less intrusive in their daily work routine.

## 5. Objectives of the Study

There are gaps in our current understanding of the effects of railway CIs on employees. We need to know more about the development of non-diagnosed effects in order to better intervene with those who do not receive a diagnosis. We also need to develop our understanding of the risk and protective factors that lead to the development of various negative effets in order to plan more effective interventions. Considering those gaps in scientific knowledge, this study has two complementary objectives. The first is to contribute to the understanding of the effects of railway CIs on train engineers and conductors by proposing a classification of these effects. The second objective is to model individual and environmental risk and protective factors to the development of various types of traumatic reactions. This will in turn provide some guidelines for the development of trauma prevention strategies adapted to the railway context.

## 6. Method

### 6.1. Participants

The inclusion criteria for participating in the study were to be an active engineer or conductor for a Canadian railway company and having been involved in at least one railway suicide during their career. This inclusion criterion was determined by the fact that the study took place in the context of a research programme aiming to understand the scope and consequences of railway suicides.

Recruitment was undertaken between January and June 2010 with the support of the project Steering Committee, specifically Canadian railway companies and the railway union (Teamsters of Canada, Railway Conference - TCRC). The railway companies and the TCRC were asked to identify and refer to the research team employees who had been involved in a railway suicide. Also an email was sent to all engineers and conductors in Canada, informing them of the project and asking for their participation. Upon request from the TCRC, the researchers presented the project and the recruitment process in regional union meetings in Alberta, Manitoba and Ontario. An announcement describing the project and the recruitment of participants was also placed on the Railway Association of Canada and on the TCRC websites. Since most crew members would not discuss work related issues with outsiders without the prior approval of their union, most participants were recruited by their union representatives who provided the research team with lists of employees who had been involved in critical incidents and would like to know more about the study. The research team contacted all interested employees and informed them about the study. Employees who agreed to take part in the study were interviewed face to face or by telephone. The interviews were audiotaped and transcribed for subsequent coding and analysis. Overall, 82 employees gave their names to be informed about the study during the recruitment period. Of these, 16 subsequently refused to participate, one was not included because he did not experience a suicide, and 20 could not be contacted after 2 attempts or were not able to schedule an interview for lack of time or changes in their work schedules. Of the 44 interviews we conducted, four were not included in the analyses: in two instances the information provided was incomplete and lacking in sufficient detail, one had a technical malfunction with audio taping and one did not experience a suicide.

It is difficult to assess exactly the number of railway crew members who were informed of the study and had an opportunity to volunteer for participation. Recruitment by railway employee unions has been a common practice in retrospective studies of the effects of incidents (Margiotta, 2000; Napper, 1998) with no indication of negative influence on results. Although the involvement of the union in the recruitment may have induced some bias in the sampling, all railway employees had an opportunity to volunteer to participate, and going through the railway union was the only way that employees would accept to discuss their experiences with outside researchers

### 6.2. Procedure

We conducted individual semi-structured retrospective interviews with the participants to obtain information on variables reported in previous research (Farmer et al., 1992; Karlehagen et al., 1993; Malt et al., 1993; Theorell et al., 1992), with the addition of questions raised during consultations with stakeholders, including representatives from the railway industry, safety organizations and Transport Canada. The interviewer asked each participant to: describe each of the suicides, accidental deaths and other work related significant events they experienced, the impact and consequences of these events on various aspects of their personal and work life, the nature of the help, support and care received from emergency services and company officials and their level of satisfaction with it. They were also asked to make recommendations to improve on current support and care practices.

Our use of a retrospective cross-sectional methodology reflected the typical approach used in prior studies of the impact of railway fatalities on employees, either with questionnaires (Kim et al., 2012; Margiotta, 2000; Meier et al., 1998; Napper, 1998; Vatshelle & Moen, 1997; Yum et al., 2006) or by interview (Briem et al., 2007). Past

studies used a combination of in-house and standardised questionnaires describing past events in general, but often with specific emphasis on the most disturbing incident (Vatshelle & Moen, 1997) or on the first and last incident (Margiotta, 2000). Some studies tried to differentiate the effects of different incidents (Briem et al., 2007; Margiotta, 2000; Napper, 1998), but most associated the past events with current self reported health measures (Kim et al., 2012; Margiotta, 2000; Meier et al., 1998; Napper, 1998; Vatshelle & Moen, 1997; Yum et al., 2006). Trying to link past traumatic events to current health status had important limitations, since symptoms and other negative effects tended to decrease within one year after the incident (Meier et al., 1998; Yum et al., 2006).

### 6.3. Database

A mixed method (Morse, 2010) was used to analyse the 40 interviews in order to understand the effects of a RFICC. A primary qualitative analysis was performed on the content of the interviews in order to identify outcome measures of reactions to RFICC and potential risk and protective factors, using a thematic approach (Mishara & Bardon, 2013). The themes were identified from previous studies and several new themes also emerged. A set of variables was defined from these themes and a systematic coding was performed for each RFICC. Each of the 122 incidents was individually coded.

The database used for the analyses was composed of 48 dichotomised and continuous variablesFactor analyses were performed on the 122 incidents to identify coping strategies used by crew members (13 coping variables) and to identify patterns of non-diagnosed reactions (12 variables) (Tabachnick & Fidell, 2013) .Our sample size allowed for these analyses, following the recommendations in statistical manuals for a minimum of 4 cases per variable (Rummel, 1970). The objective of these analyses

was to reduce the number of individual variables included in further analyses by identifying meaningful latent structures. Factor analyses used a principal component method with varimax rotation. The factors that were retained were selected using the method of scree plot analysis (Tabachnick & Fidell, 2013). Univariate analyses (Pearson correlations) were performed to test for significant correlations between potential predictors and the outcome variables of reactions to the RFICC.

Pathway analyses using AMOS 6.0 were performed to describe the potential pathways to the development of different reactions. We hypothesized that factors concerning pre-existing conditions and the context, individual characteristics, incident management, immediate reactions and coping mechanisms combined to explain the development of varied traumatic reactions. Since the models were built from hypothesis, the use of latent variables was not required and pathway analyses were more appropriate than Structural Equation Modeling. Only variables that correlated significantly in the univariate analysis were entered in the models. The main postulate for pathway analysis was linearity of variables. Both dichotomised and continuous variables included in our database respected this postulate of linearity and were included in the analysis. Dummy variables were created for categorical variables with more than 2 values, as prescribed by Cohen and Cohen (1983). The sample size required for exploratory pathway analysis has been established as 5 cases per variables (Cohen & Cohen, 1983; Tabachnick & Fidell, 2013). A maximum of 27 variables were used in the pathway analyses, requiring a minimum sample size of 108 cases.(Cohen & Cohen, 1983; Tabachnick & Fidell, 2013).

# 7. Results

## 7.1. Inter-raters agreement

In order to verify the reliability of the data coding, two persons independently coded all 48 variables in a subsample of 46 cases, which resulted in a mean Kappa of .77. According to the classification by Landis and Koch (1977), substantial agreement (kappa >.600) was achieved for 17 variables (35%), almost perfect agreement (kappa >.800) was achieved for 23 variables (48%) and the remaining 8 variables (17%) achieved moderate agreement (kappa >.400).

## 7.2. The negative effects of railway RFICC on Crew

Interviewees described both mild and intense reactions as well as both very positive and negative experiences of incident management and the support received at different times in their careers. The effects experienced by interviewees could be a fairly accurate reflection of the scope and nature of the actual impact of railway critical incidents, since they matched findings from other studies of the impact of railway critical incidents. Our incidence of PTSD of 17% is close to the 4% to 16% range observed in previous studies (Cothereau, 2004; Farmer et al., 1992; Limosin et al., 2006; Margiotta, 2000).

The wide range of reactions and satisfaction with services, as well as PTSD levels, is comparable to previous studies. This suggests that our sample experienced the types of events and range of support services that would be useful in describing factors associated with the reactions or employees who experienced at least one suicide in their carreer. The final sample consisted of 40 interviews, describing 122 incidents (Mean: 3.05 incidents described per person, ranging from 1 to 9), including 46 (37.7%) fatal accidents, 12 (9.8%) non-fatal incidents, 47 (38.5%) suicides and 17 (13.9%) other

types of incidents (found bodies or close calls). Those incidents took place between the early nineteen seventies and 2010. The mean seniority of the interviewees was 28.6 years (*SD* = 8.22 years). Only one participant was a woman, reflecting the demographics of this population. Overall, the participants had a mean of 4.5 incidents in their career, ranging from one to 22. Those with many incidents could not remember them all and therefore could not give details on all of them; this explains the smaller number of incidents included in the analysis. The inclusion criterion for incidents in the final analysis was the ability of interviewees to remember them in detail.

### 7.2.1. Non diagnosed reactions

Preliminary data analysis provided 12 reaction variables that were included in the factor analysis (see Table 1). Four factors were retained according to the scree plot analysis. The Bartlett test of sphericity was significant ($\chi^2 = 128.750$, $df = 66$, $p < .001$). Variables with a saturation greater than .46 were retained in the definition of the factors.

*Insert Table 1 about here*

The first factor, we called "Agitation", explained 14.95% of the variance and had a high saturation on rumination, upset, sleep problems and hyper-vigilance. The second factor, we called "Disturbed Functioning", explained another 13.53% of the variance and had a high saturation on guilt, concentration problems and general impairment. The third factor, we called "Anger", explained an additional 12.64% of the variance and had a high saturation on irritability, anger, flashbacks, and a negative saturation on grief reaction. The fourth factor, called "Fatigue", explained 10.32% of the variance

and had a high saturation on fatigability. Together, these four factors explained 51.42% of the variance. Four variables were created from these factors and were used as dependant variables in further analyses. These four types of non-diagnosed reactions were present at various degrees in crew members: Agitation (80.3% of cases), Disturbed Functioning (28.7% of cases), Anger (47.5% of cases) and Fatigue (5.7% of cases).

### 7.2.2. Mental health problems

The presence of a mental health problem was defined as having had a diagnosis of Post Traumatic Stress Disorder (PTSD), Depression, Anxiety or Phobia, based upon official diagnoses received by the interviewees, by the conditions and length of their leave of absence under the care of the Workers Compensation Board or by the nature of the treatment they received. A total of 23.8% of cases were classified as suffering from a traumatic reaction (PTSD diagnosed or suspected) and a further 18.9% of respondents were diagnosed or strongly suspected as having had PTSD or another mental health problem based upon descriptions of the treatment received and the time off work for having depression, phobia or anxiety. Mental health problems were identified after 42.6% of the incidents.

### 7.2.3. Duration of negative effects

The duration of symptoms and effects was estimated by the respondents and calculated in days (Table 2) with a mean duration of 1589.83 (*SD* = 3035.88). In three cases, the employees never returned to work after the incident. It is important to note that for 38.7% of incidents, symptoms lasted less than one month, but for 18.3%, people lived with the consequences of the incident for more than 10 years, and sometimes felt that they will be affected for life.

*Insert Table 2 about here*

7.2.4. Correlations between outcome variables

Table 3 presents the correlations between the five outcome variables. There were several significant correlations, however the only correlation explaining more that 5% of the variance was between Mental Health Problems and Disturbed Functioning ($r = .325, p < .001, df = 120$).

*Insert Table 3 about here*

7.2.5. Incidents that had little or no impact

In order to further our understanding of reactions patterns, an outcome variable was composed from incidents when crew members reported that they had no adverse effects (10 cases, 9.4%) and those for whom adverse effects lasted for only seven days or less (26 cases, 24.5%). Thus, the negative effects were very limited in time and scope and people returned to normal fairly quickly after almost 35% of RFICCs.

7.3. Models of variables associated with post incident reactions

7.3.1. Factors included in pathways analyses

7.3.1.1. Coping Factors

The factor analysis of 13 coping variables identified three components. According to the scree plot analysis (see Table 4). The Bartlett test of sphericity was signficant ($\chi^2 =$

206.753, $df = 78$, $p < .001$). Variables with a saturation greater than .30 were retained in the definition of the factors.

*Insert Table 4 about here*

The first factor, which we called "Externalised Coping" explained 16.47% of the variance and had the highest saturation on the following 5 variables: using social support, helping others, empathy, disclosure, and a negative saturation on repressive coping. The second factor, which we called "Action Coping", explained an additional 13.58% of the variance and had the highest saturation on the following variables: involvement, exercise, getting away, and a negative saturation on acceptance and seeking information about the victim. The third factor, called "Avoidant Coping", explained a further 11.15% of the variance and had a high saturation on avoidant coping, attribution of fault to the victim, disclosure, repressive coping and substance use. Together, these three factors explained a cumulative variance of 41.21%.

#### 7.3.1.2. On site reactions

Some past studies found that crew members who had strong immediate reactions also had long term effects (Cothereau et al., 2004; Karlehagen et al., 1993; Theorell et al., 1992) and others did not find any association between the two (Margiotta, 2000). In order to help clarify this debate, we included the following on-site reactions as potential predictors of negative effects: Fear at the time of incident for their own safety or life (49.2% of cases), Physiological reactions experienced within minutes or hours after impact, such as heart racing, sweating, shaking, tunnel vision (32.0% of cases), feeling of helplessness to have prevented the incident from happening or in managing the situation within the first few hours (32.8% of cases), intense fatigue

immediately after the incident and within the first few hours (11.5% of cases), feelings of being emotionally dissociated from the events (13.9% of cases).

We conducted a factor analysis of the above five reactions. However, the Bartlett test of sphericity was not significant ($\chi 2 = 16.595$, $p = .084$, $df = 10$), indicating that these five factors could not be grouped together. They were thus included independently in subsequent analyses.

#### 7.3.1.3. Other Independent Variables Included in Analyses

We identified the following potential predictors of post incident reactions using Pearson correlations: pre-incident and contextual variables (before the incident occurred or independent of incident management), incident characteristics, incident management (by the company and emergency services) and coping strategies (see Table 5).

*Insert table 5 about here*

### 7.3.2. Pathway analysis

Preliminary bivariate correlation (linear regressions) identified relevant independent variables and significant correlations patterns between variables (see Table 5). Pathway analyses were performed with all outcome measures independently. Following recommendations from Cohen and Cohen (1983) and Tabachnick and Fidell (2013), we decided to only retain models with a $R^2 > .20$ because models explaining less that 20% of the variance in outcomes could not provide enough explanatory power to help design useful and effective prevention strategies.

#### 7.3.2.1. Presence of a mental health problem

The model fitted the data well enough ($\chi 2 = 88.737, df = 62, p = .015$, *CFI* = .860 and *RMSEA* = .060) and the overall $R^2 = .322$, indicating that the model explained 32.2% of the variance in developing Mental Health Problem after a RFICC (Figure 1).

*Insert Figure 1 about here*

7.3.2.2. Agitation

The model fitted the data well enough ($\chi^2 = 38.373, df = 21, p = .012$, *CFI* = .854 and *RMSEA* = .083) with an overall $R^2 = .300$, indicating that the model explained 30% of the variance in developing Agitation after a RFICC (Figure 2).

*Insert figure 2 about here*

7.3.2.3. Fatigue

The model fitted the data well enough ($\chi^2 = 28.304$, $df = 28$, $p = .448$, *CFI* = .997 and *RMSEA* = .009), with overall $R^2 = .201$, indicating that the model explained 20.1% of the variance in developing Agitation after a RFICC (Figure 3).

*Insert figure 3 about here*

7.3.2.4. Duration of effects

The model fitted the data well enough ($\chi^2 = 52.3$, $df = 28$, $p = .004$, *CFI* = .751 and *RMSEA* = .060). The overall $R^2 = .274$, which indicated that the model explained 27.4% of the variance in the length of negative effects after a RFICC (Figure 4).

*Insert figure 4 about here*

#### 7.3.2.5. No or Limited Impact

The model fitted the data well enough ($\chi^2 = 17.004$, $df = 10$, $p = .074$, $CFI = .874$ and $RMSEA = .076$). The overall $R^2 = .335$, which indicated that the model explained 33.5% of the variance in the fact that crew experience no or limited impact of RFICC (Figure 5).

*Insert Figure 5 about here*

## 8. Discussion of Results and Recommendations for Prevention of Traumatic Reactions

Although self-reporting of past events could, in some cases, limit the validity of the data because of recall bias, resulting in under or over estimation of emotions, difficulties to place events and problems in chronological order (Vatshelle & Moen, 1997; Yum et al., 2006), it could be argued that railway critical incidents were so devastating that theyare easy to remember (Vatshelle & Moen, 1997). In the present study, we followed the recommendations of Kim et al. (2012), Margiotta (2000) and Napper (1998) by considering the impact of separate incidents without trying to associate a variety of past events with current health status. We began with open ended questions to make sure that we considered all aspects of the impact of the incidents.

Involvement in a RFICC, primarily a fatality, has a variety of important negative effects on railway crew members. In past studies, the main focus has been on PTSD as the main negative outcome. However, we found that potential reactions range from resilience and quick recovery to longstanding psychosocial and mental health problems. We found that PTSD and the presence of several PTSD symptoms,

sometimes referred to as "sub-threshold" or "partial" PTSD (Breslau et al., 2004; Breslau, Reboussin, Anthony, & Storr, 2005; Cukor, Wyka, Jayasinghe, & Difede, 2010; Grubaugh et al., 2005) are present after 23.8% of incidents and diagnosed PTSD was experienced by 7 crew members (17.5% of the sample). Some people also experienced repeated PTSD episodes.

Recent studies of the effects of potentially traumatic events consider these effects on a continuum rather than dichotomised (Bonanno & Mancini, 2012; Breslau, 2009; Zlotnick et al., 2002). This allows for a more comprehensive analysis beyond simply identifying diagnosed mental health problems. The prevalence of the various effects measured by this study is indicative of the wide range of negative effects of critical incidents on crew members.

Researchers studying sub-threshold or partial PTSD (Cukor et al., 2010; Grubaugh et al., 2005; Stein, Walker, Hazen, & Forde, 1997; Zlotnick et al., 2002) conclude that partial PTSD does not have a specific causal path and may induce important functional impairment. In our study, depression, phobia or anxiety were present in 18.9% of participants who did not have PTSD. Since these disorders are often strongly correlated in trauma victims and since the crew members we interviewed did not always know the specific diagnosis they were given, we grouped together depression, anxiety, phobia and PTSD in a broad Mental Health category.

Diagnosable mental health problems are only a part of the problems of crew members. Disturbed Functioning is experienced after 28.7% of RFICCs and is correlated with the presence of Mental Health Problems. The incidence of Disturbed Functioning indicates that crew members' ability to work may be compromised after a RFICC. Therefore, feeling guilty, having concentration problems and general trouble functioning should be assessed when evaluating the fitness to work, independently of a formal psychiatric diagnosis.

We find that agitation, composed of rumination, being generally upset, having sleep disturbances and hyper-vigilance at work, is the most common (80.3%) post incident reaction. A large subsample (47.5%) experience an angry reaction, sometimes accompanied by flashbacks, but never by grief. The anger can be directed to the incident, the victim or the employer. This outcome factor is not correlated with other post RFICC reactions nor can be explained by pathway analysis. The variety of targets of this anger may explain why we could not describe the factors associated with its development. It appears that for these male employees, anger is easier to recognise, accept and cope with than grief, depression or trauma, possibly due to masculine stereotypes (Galdas, Cheater, & Marshall, 2005).

Prolonged fatigue develops after 5.7% of RFICCs. It is not statistically associated with other outcome variables and can be a mid or long term reaction. The association between exposure to traumatic events and fatigue has also been demonstrated with nurses (Adriaenssens & Stan, 2012).

The presence of non-diagnosed, non-recognised significant effects, including loss of concentration, increased impairment and work related mistakes, can have dire consequences on safety critical positions such as train conductors and engineers. When crew members make mistakes after a RFICC and are sanctioned, they may feel victimised twice (by the incident and by their employer), work relations may deteriorate further, and the likelihood of seeking help from work provided resources is reduced.

Recovery is defined by the ability to regain a normal level of functioning following a stressful life event, after having experienced negative effects for a certain length of time (Bonanno, 2004). In the context of railway critical incidents, recovery is a common outcome: in 65.6% of RFICCs, negative effects were limited in time and people returned to normal within one year. However, the period considered as an

adequate recovery time has been rarely discussed and length of time before full recovery is achieved cannot be simply derived from the time taken off work after the incident, since negative effects (*mean*: 1479.6 days, *SD*: 2955.7) can last longer than the leave of absence (*mean*: 45.9 days, *SD*:178.3).

Another key concept, resilience, is defined as the ability to maintain a stable equilibrium and level of functioning despite the presence of potential traumatic events (Bonanno, 2004). Some form of resilience could be observed in almost 35% of incidents which had no adverse or only short term effects (less than 7 days). Among the various paths to resilience described by Bonanno (2004), repressive coping, where people avoid memories and do not report negative emotions, plays a large part. In our sample, employees who used avoidance experienced less intrusive effects, hence displaying some levels of resilience.

The various types of effects we observed in railway employees can also be analysed with the externalising / internalising / low pathology model developed by Miller, Kaloupek, Dillon et al. (2004) with combat veterans. This study showed that veterans with a diagnosis of PTSD could display three subtypes of PTSD. The first type, externalising PTSD, is characterised by high levels of anger, cynicism, antisocial practices, alcohol misuse and low social responsibility. The second type, internalising, is characterised by high comorbid levels of depression, high repression coping and social discomfort and low self-esteem. The final subtype, low pathology, is defined by low anxiety, fear and health concerns and high social responsibility. These results have been replicated with other samples of traumatised military personnel, for example by Flood, Boyle, Calhoun et al. (2010). Although they were not always formally diagnosed with PTSD, railway crew members experienced comorbidity with anxiety or depression, disturbed functioning that share elements with the internalising subtype. Agitation and anger reactions could be linked to externalising subtypes. It would be

useful to analyse larger samples of diagnosed railway employees to assess the incidence of these various subtypes of PTSD in non-military samples.

## 8.1. Predicting the Type of Reaction to a Traumatic Event

On the basis of our pathway analyses, we have identified the following variables that may impact the development of traumatic reactions and that may be the object of prevention programs. They are discussed here in the order they appear in the pathway models (see figure one to five), from the more proximal to the more distant in time.

### 8.1.1. Coping Styles or Behaviours

In our study, coping factors do not seem to play a significant role in the development of non diagnosed reactions nor on the duration of negative effects. However, they are involved in the development of mental health problems. Avoidant Coping, where people do everything they can to limit their exposure to Cis and their aftermath, is associated with a reduced prevalence of mental health problems and Externalised Coping, where people share information and emotions, get involved and empathise with the victim, is associated with an increase in mental health problems. This finding may be explained by the fact that crew members who have more intense negative reactions (such as a mental health problem) are more likely to seek help and disclose their emotions. People who display Avoidant Coping shield themselves from the incident and appear to succeed in reducing the risk of developing a mental health problem. In the context of RFICC, avoidance may be a beneficial coping strategy for crew members, although it is not generally considered beneficial in other situations.

### 8.1.2. Immediate Reactions after a Traumatic Event

PTSD and traumatic reactions are likely to occur when the person experiences helplessness, horror and fear (Brillon, 2010). Peri-event emotional dissociation has also been strongly associated with the development of a traumatic reaction (van der Hart, van Ochten, van Son, Steele, & Lensvelt-Mulders, 2008). Although these immediate reactions are common in our sample, most of their direct influence disappears in pathway analyses. Emotional dissociation remains the only on site reaction associated with negative outcomes. Its influence on Mental Health Problems, Agitation and Fatigue is mediated by the perception of the incident management. Emotional dissociation occurs more often when the crew saw the face or eyes of the victim prior to impact. Crew members who saw the face of the victim are more likely to be sensitive to negative incident management, so according to our results, special care should be taken to protect them from management hiccups.

The Fear experienced by crew is rarely a fear for their own lives, as it often happens in other types of traumatic events. Therefore, it is likely to have a reduced effect on the development of a traumatic reaction, when compared to findings from other populations (Ozer, Best, Lipsey, & Weiss, 2008).

### 8.1.3. Incident Management

RFICC management is strongly related to the outcome measures. Previous research linked poor incident management to anger (Abbott et al., 2003), but our study shows a number of other important associations. The number of negative incident management elements is related to the development of mental health problems, agitation, disturbed functioning, fatigue, and the duration of negative effects. Pressure to return to work is negatively correlated with having little or no impact of the event. Therefore the more pressure employees experience, the more negative

effects they are likely to develop after the CI. Negative incident management includes long delays before help arrives, absence of a supervisor on site, being victimised at the scene, having a conflictual or distrusting relationship with the supervisor, being treated with suspicion by police or supervisors, having a conflict with the employer regarding post incident treatments and leave of absence, feeling pressure to keep on working or returning to work before feeling ready, being asked to help deal with the RFICC scene, and non-respect of the post incident management protocol. Positive incident management includes timely arrival of help, obtaining enough help and support, presence of peers, positive interactions with the supervisor and police, post-incident briefing, absence of pressure to return to work and presence of and adherence to a post incident intervention protocol. The presence of positive incident management elements does not always counter the impact of negative management, except in terms of the duration of effects. This means that even if an incident is well managed in general, the presence of at least one management problem may have long term consequences.

Incident management does not seem to have been considered as a risk factor in the development of post RFICC traumatic reactions in previous reports. Still, proper CI management is described as a way to reduce negative effects of incidents on employees in other work areas (Burke, 2012). It also has been identified as a contextual element of traumatic incidents that may help improve recovery and resilience (M. R. Harvey, 2007). Work organizations are not usually seen as potentially part of the traumatic experience, but as part of the healing and recovery after a traumatic event (Greenberg & Wignall, 2012; Kinder & Rick, 2012; McFarlane & Bryant, 2007; NICE, 2009; Paton et al., 1998). However, there are some indications that negative attitudes by first line management or lack of efforts from the employer to accommodate the employee in times of crisis may reduce the chances for workers

to be fit for work and return quickly (Kinder & Rick, 2012). Results from our study confirm that more attention should be given to the potential negative effects of incident management in the development of traumatic reactions after a RFICC.

### 8.1.4. Incident Characteristics

The number of injured victims has a negative correlation with agitation, which means that the presence of live victims is associated with fewer symptoms of agitation after a RFICC. This counter-intuitive association may be explained by the fact that when there are more live victims, the employee may be involved more positively in the incident management, and feel less helpless because he can act to help save a life, regaining a sense of control and competence. This may help reduce post incident agitation. Further research needs to be conducted to validate this interpretation.

The number of fatalities during an incident is associated with emotional dissociation in the development of mental health problems and with a positive interaction with police in reducing the duration of negative effects. This last finding emphasises the importance of good incident management. Even if there are several victims, when the interaction with police officers at the scene is caring and positive, crew members are likely to experience shorter effects. Also, CIs with more victims (much rarer than single victim events) may induce a more caring attitude from first responders.

The perception of the victim's vulnerability is a predictor of mental health problems, agitation and the duration of negative effects and is negatively correlated to having little or no impact of the RFICC. This result confirms previous findings on risk factors for work related trauma (McFarlane & Bryant, 2007), where identification of the worker with the victim or feelings of empathy toward the victim increase traumatic reactions. In some cases the information crew members obtain about the victim can be a protective factor, when it emphasises the responsibility of the victim in their own

demise. However, when it confirms the helplessness and vulnerability of the victim, it may increase the negative impact on the crew. Police and first respondents should be aware of this potential negative effect of knowing more about the victim.

### 8.1.5. Pre-incident and Contextual Variables

Pre-existing factors have been often identified as risk factors for the development of traumatic reactions (Ozer et al., 2008). However, in our study they do not appear to be significant, reflecting conclusions from previous railway trauma studies that did not find an association between personality types and effects of railway CIs (Abbott et al., 2003; Briem et al., 2007; Margiotta, 2000).

Also, prior traumatic events, although a common risk factor in other workplaces (Ozer et al., 2008), were not significant in our sample. The number of previous events was entered in the correlation analyses and was not significantly associated to any outcome variable.

Age remains a factor in the duration of the negative effects of CI. The younger the person was at the time of incident, the longer lasting the negative effects. This may well reflect the fact that support protocols are fairly recent and that during their early career, interviewees were left to cope with traumatic events on their own. Seniority, on the other hand increases the risk of fatigue, partly through increased work related stress. This may be one of the indicators of the cumulative effect and should be included in future studies about this issue.

Personality factors have been associated with the development of PTSD. Particularly, persons who display "hardiness" traits are more likely to cope more effectively with stressful events and are less likely to develop PTSD (Martin, Germain & Marchand, 2006). These persons are characterised by social engagement, sense of control and an attraction to challenges. Personality was not studied in the present research

project. The main focus of the interviews was on the incidents and their aftermath. Since it was an exploratory study, we did not include any standardised instruments and we made the choice of spending more time on the narrative of the experiences of our interviewees. This approach presents limits since personality is known to affect reactions to traumatic events. However, this limitation also allowed us to develop a trusting relationship with interviewees and gave them the needed space to express their experiences and discuss rarely discussed risk factors, particularly related to the work context.

### 8.1.6. Long term work related factors

The work context influences the outcome of RFICC. Being a conductor means that the employee has to come out of the train after impact to assess the situation and provide first aid when possible. This may explain part of the peri-event emotional dissociation conductors are more likely to experience in association with increased fatigue. In most cases, employees are conductors earlier in their career and later become engineers. Therefore, the association between being a conductor and the perception of negative incident management in the development of mental health problems may reflect the fact that these incidents took place before more complete support protocols were implemented in the railway industry.

The quality of the work relations and the level of work related stress at the time of the RFICC influence the level of helplessness experienced at the time of incident. It is important to note that the influence of these work related factors is mediated by what happens at the site of the incident. Having positive work relations is a direct predictor of no or limited impact of RFICCs. Positive work relations are defined here as trusting and respectful interactions with the employer in general, the perception that everything is functioning as it should between the employees and their employer. This

finding confirms what is known about incident management and the importance for the employer to support employees in time of trauma (Burke, 2012; Greenberg & Wignall, 2012; McFarlane & Bryant, 2007; Rick, Kinder, & Boorman, 2012). However, our models show that the effect of the work context is often trumped by the quality of the incident management at the time of the RFICC. The focus should be on incident management first, before working to improve the larger work context, although this should not be neglected. Interventions to improve the work environment should increase wellness and resilience (Garcia-Dia, DiNapoli, Garcia-Ona, Jakubowski, & O'Flaherty, 2013; Harvey, 2007).

### 8.2. Strengths and Limits of the Study

Although this study is retrospective and may be limited by self-selection bias, observed effects resemble those found in other studies of railway employees. Although one might have expected an over representation of heavily traumatised participants due to the involvement of the union in the recruitment, we found a wide range of reactions and the overall level of traumatic reactions was comparable to previous studies. However, some stakeholders feel that since the retrospective reports include events over the past 40 years, the experiences reported may not reflect today's reality in the railway industry in Canada.

The possibility of a self-selection bias in our sample, where people who agreed to take part may have been those who experienced the strongest negative effects after a RFICC was discussed with stakeholders in the Canadian railway industry who were on the Steering Committee for this research project. Industry representatives felt that people with a quick recovery pattern were probably under-represented in our sample, because they probably did not feel the need to share their experiences and their

positive interactions with their employers. However, they felt that the processes described accurately reflect the types of situations experienced by crew members.

## 9. Conclusion

This exploratory study presents an in-depth analysis of the experience of railway crew members with work related RFICCs, over the course of their careers. The pathway analyses allows us to better describe the risk and protective factors at play in the development of various traumatic reactions after such incidents. The mixed method used in the analysis, including a qualitative thematic approach, the identification of reactions and coping factors and pathway analyses, combines the strengths of different methods of analyses and offers complementary perspectives on the corpus of the interviews.

Reactions to traumatic events can take several forms for railway crew members. A simple binary approach based on the presence or absence of diagnosed mental health problems limits our understanding of the heterogeneity of effects of RFICCs, and therefore the range of prevention programs, support and care that may be identified to help employees. This current study describes various effects that can be understood on a continuum from full recovery to long term mental health problems, using categories that can be more easily observed in employees. In that sense it goes one step further than our qualitative preliminary analysis (Mishara & Bardon, 2013).

The study also helps in our understanding of risk and protective factors for the development of negative effects after work related traumatic events. In this context, it identified work related factors that be important leverage to develop preventive strategies. We found that work related factors which can be modified, play a large part in the development of negative effects of a RFICC and also may play a strong protective role.

Existing programs and regulations for the prevention, care and support after RFICC rarely take into account the variety and length of the traumatic effects on railway workers. The reliance on a diagnosis dichotomises our understanding of reactions and misses the full spectrum of significant effects that can impact workers' health, well-being and work performance. It also limits access to help and support, since people with a diagnosis obtain help and those without often do not. Besides having a diagnosed traumatic reaction, other frequently occurring effects of a RFICC can affect employees deeply and place them at risk of making mistakes in safety critical positions. The absence of nuance in the understanding and analyse of traumatic reactions reduces support and increases risk.

What we learned from this analysis of the paths to the development of traumatic reactions after a railway CI may also be applied to other work environments where CI are likely to occur and that share some characteristics with the railway industry, where employees are not professional first responders but are involved as participant, witnesses and first responders to incidents. These characteristics are shared by other transport industries, mining and some heavy industries.

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Table 1

*Factor Loadings for Non Diagnosed Reactions (Rotated Component Matrix Varimax with Kaiser Normalization)*

| | Component | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Ruminations | .762 | | | |
| Upset | .623 | | | |
| Sleep Problems | .528 | | | |
| Subsequent Hyper Vigilance when Working | .472 | | | |
| Guilt and Self-Blame | | .806 | | |
| Concentration Problems | | .566 | | |
| Impairment in the General Functioning | | .524 | | |
| Irritability | | | .662 | |
| Anger | | | .528 | |
| Flashbacks | | | .503 | |
| Grief Reaction | | | -.592 | |
| Increased Fatigue | | | | .851 |

Extraction Method: Principal Component Analysis.

Rotation converged in 6 iterations.

Table 2 Duration of symptoms and negative effects of RFICC on crew

| | N | % |
|---|---|---|
| No negative effects | 10 | 9.4 |
| 7 days or less | 26 | 24.5 |
| 8 to 30 days | 10 | 9.5 |
| 31 days to 90 days | 9 | 8.5 |
| 91 days 6 months | 8 | 7.5 |
| 6 to 12 months | 8 | 7.5 |
| 1 to 5 years | 10 | 9.4 |
| 5 to 10 years | 5 | 4.7 |
| More than 10 years | 20 | 18.9 |
| Total | 106 | 100 |

Table 3

*Correlation Matrix for Outcome Variables (r)*

| | Mental health problem | Agitation | Disturbed Functioning | Anger | Fatigue |
|---|---|---|---|---|---|
| Mental Health Problem | | | | | |
| Agitation | .144 | | | | |
| Disturbed Functioning | .325* | .153 | | | |
| Anger | -.083 | .187* | .037 | | |
| Fatigue | .144 | .047 | .156 | -.005 | |
| Duration of Effects | .214* | -.045 | .125 | -.056 | -.020 |

*P<.05, *df*: 120

Table 4

*Factor Loadings for Post Incident Coping Strategies (Rotated Component Matrix, Varimax with Kaiser Normalization)*

| | Component | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Social Support | .708 | | |
| Helping Others | .670 | | |
| Projection / Empathy | .606 | | |
| Disclosure | .599 | | .443 |
| Repressive Coping | -.453 | | .367 |
| Exercise | | .699 | |
| Leave Home for a While | | .606 | |
| Involvement in Programme to Help Others | | .520 | |
| Acceptance | | -.354 | |
| Crew Member Is Actively Looking for Information about the Victim | | -.555 | |
| External Attribution | | | .707 |
| Avoidant Coping | | | .617 |
| Substance Use | | | .344 |

Extraction Method: Principal Component Analysis.

Rotation converged in 4 iterations.

Table 5

*Independent Variables Coded from the Interviews for Statistical Analysis*

| Domain | Variable Name | Definition | *n* | *Type of measure* | *M (SD)* | % |
|---|---|---|---|---|---|---|
| Pre-incident and contextual variables | Age | Age of the employee at the time of incident | 105 | Continuous | 36.3 (9.917) | |
| | Seniority | At the time of incident in years | 115 | Continuous | 16.4 (4.822) | |
| | Work Relations | Perceived quality of work relations with the employer at the time of incident (1: bad, 2: neutral, 3: good) | 81 | Continuous | 1.68 (0.609) | |
| | Work Stress | General perceived level of work related stress at the time of incident (1: high level of stress, nothing positive, 2: equivalent level of stress and positive perceptions, 3: low level of stress, high level of positive perception) | 74 | Continuous | 2.3 (0.535) | |
| Incident characteristics | Vulnerability | Perceived vulnerability of the victim by crew | 122 | Dichotomised | | Yes : 33.6% |
| | Number Dead | Number of persons deceased in the incident (range from 0 to 2) | 122 | Continuous | 0.79 (0.502) | |

Table 5

*Independent Variables Coded from the Interviews for Statistical Analysis*

| Domain | Variable Name | Definition | *n* | *Type of measure* | *M (SD)* | *%* |
|---|---|---|---|---|---|---|
| | Number Injured | Number of persons injured in the incident (range from 0 to 4) | 122 | Continuous | 0.22 (0.596) | |
| | Type of Incident | Integrated in subsequent analysis as a set of dummy variables (Accident / Suicide) | 122 | Dummy variables | | Fatal Accidents: 37.7% Suicides: 38.5% Non Fatals and Close Calls: 23.7% |
| | Saw Eyes or Face | Crew member saw the face or the eyes of the victim prior to impact | 122 | Dichotomised | | Yes: 29.5% |

Table 5

*Independent Variables Coded from the Interviews for Statistical Analysis*

| Domain | Variable Name | Definition | *n* | *Type of measure* | *M (SD)* | *%* |
|---|---|---|---|---|---|---|
| | Sounds | Crew member described the sounds of the incident | 122 | Dichotomised | | Yes: 29.6% |
| Incident management | Company Support | Post incident support programme in place in the company | 122 | Dichotomised | | Yes: 63.9% |
| | Satisfaction Support | Satisfaction with support provided by the employer | 122 | Dichotomised | | Yes; 59.0% |
| | Positive Management | Number of positive incident management behaviour (range from 0 to 10) | 122 | Continuous | 2.17 (1.936) | |
| | Negative Management | Number of negative incident management elements behaviour (range from 0 to 10) | 122 | Continuous | 2.39 (1.693) | |
| | Interaction with Police | Perceived quality of interaction with the police on site(1: bad, 2: neutral, 3: good) | 66 | Continuous | 2.05 (0.732) | |
| | Interaction with Manager | Perceived quality of interaction with local manager(1: bad, 2: neutral, 3: good) | 71 | Continuous | 1.62 (0.702) | |

Table 5

*Independent Variables Coded from the Interviews for Statistical Analysis*

| Domain | Variable Name | Definition | *n* | *Type of measure* | *M (SD)* | *%* |
|---|---|---|---|---|---|---|
| | Satisfaction with Incident Management | Perceived quality of interaction and level of satisfaction with various management (range from 1 to 9) | 108 | Continuous | 3.22 (1.747) | |
| | Victimized | Crew member felt victimised during incident or in the aftermaths of the incident | 122 | Dichotomised | | Yes: 13.1% |
| Coping strategies | Leadership | Crew member took leadership in the incident management on site | 122 | Dichotomised | | Yes: 31.1% |
| | Search Information | Crew member was actively looking for information about the victim | 122 | Dichotomised | | Yes: 10.7% |
| | Fault to Victim | Attribution of responsibility of the event and / or of suffering to victim | 122 | Dichotomised | | Yes: 43.4% |

*Figure 1* – Pathway Analysis on Mental Health Problems

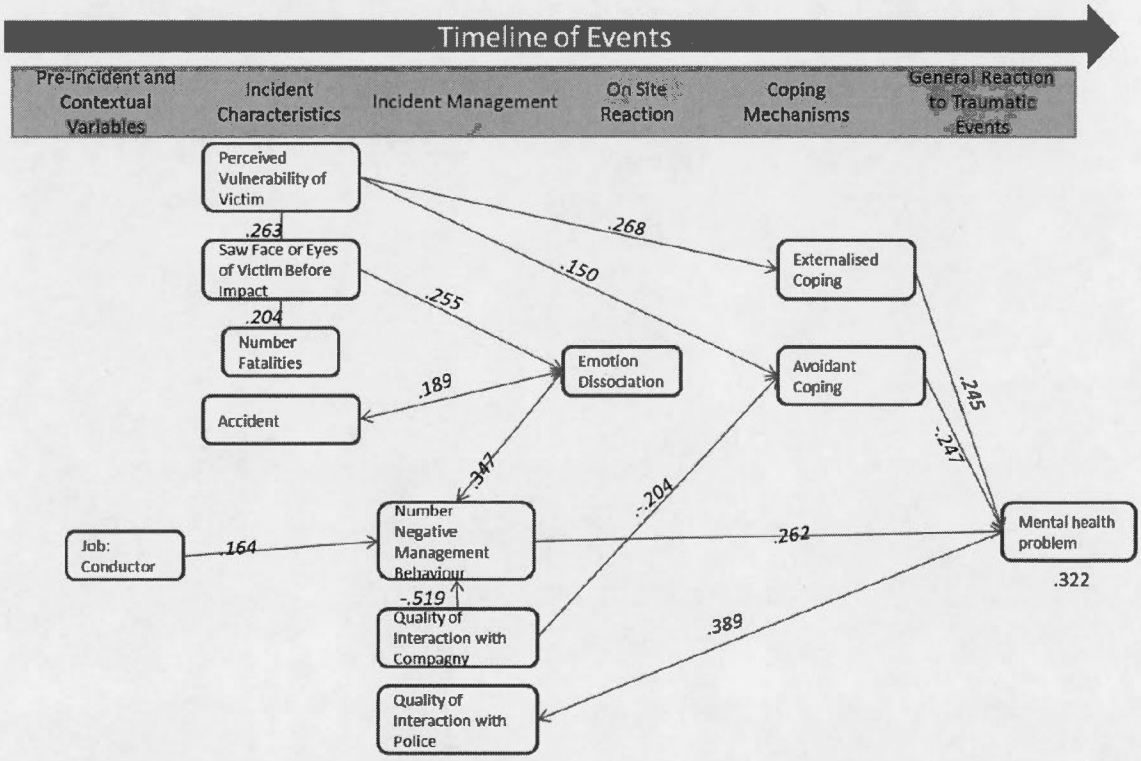


Figure 1. Pathway Analysis on Mental Health Problems

Figure 2 – Pathway Analysis on Agitation

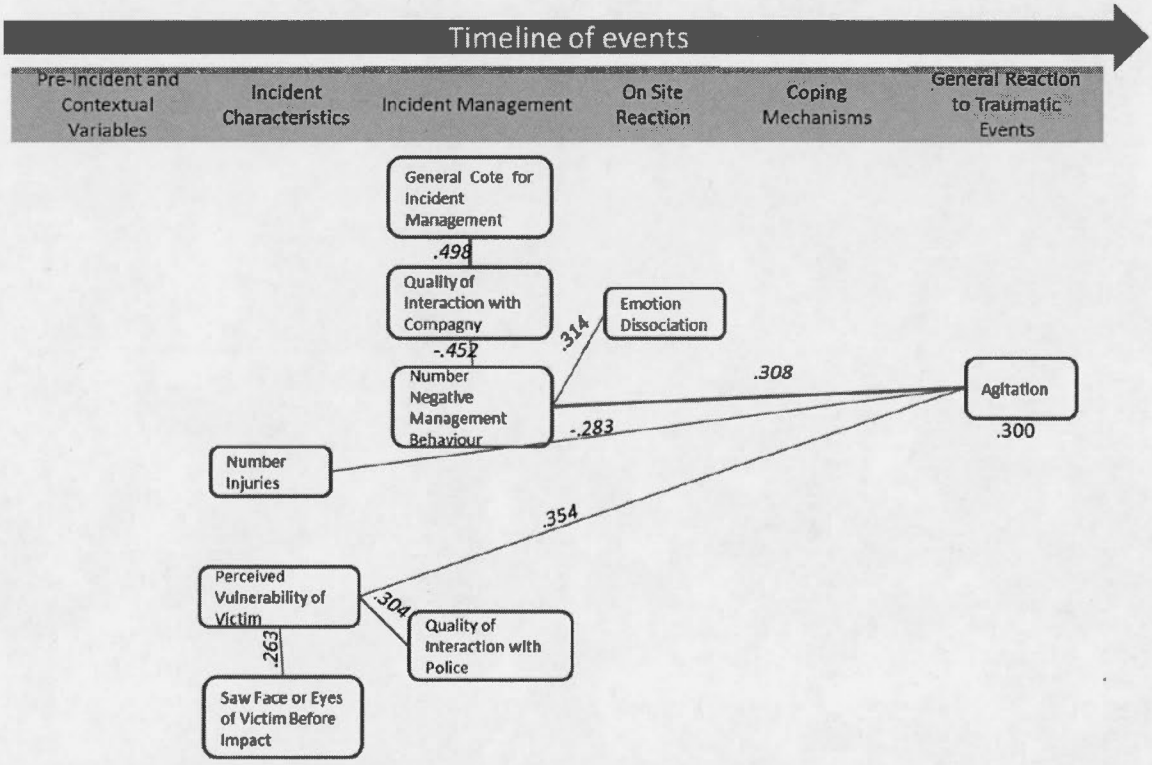


**Figure 2. Pathway Analysis on Agitation**

Figure 3 – Pathway Analysis on Fatigue

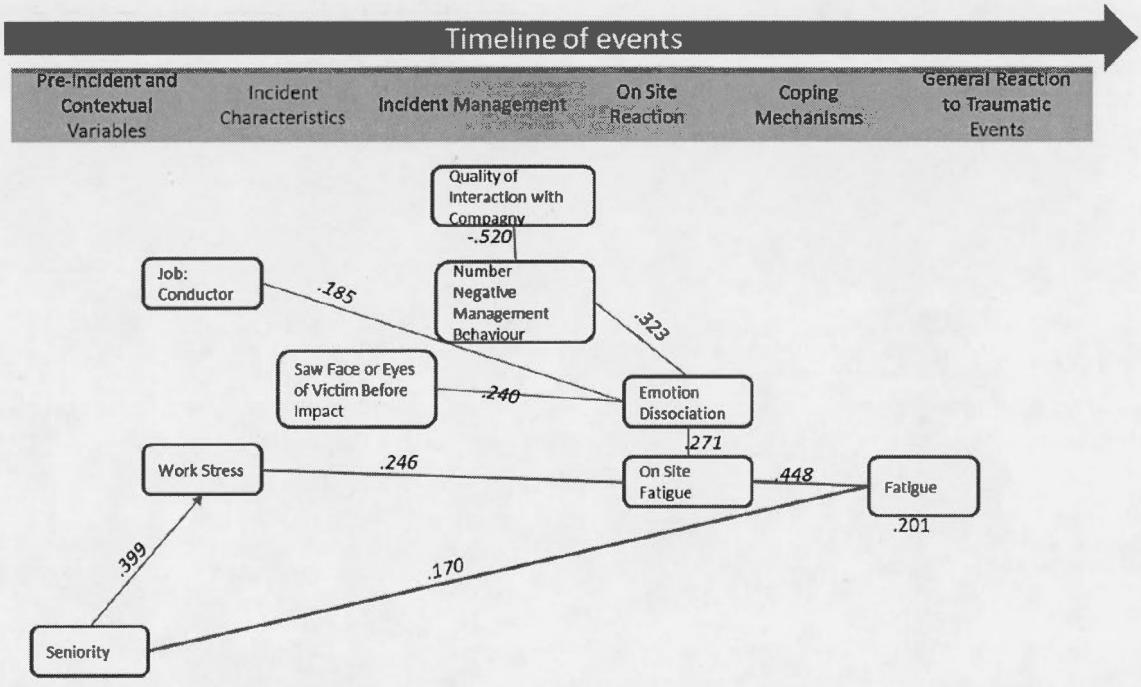


Figure 3. Pathway Analysis on Fatigue

Figure 4 – Pathway Analysis on Duration of Negative Effects

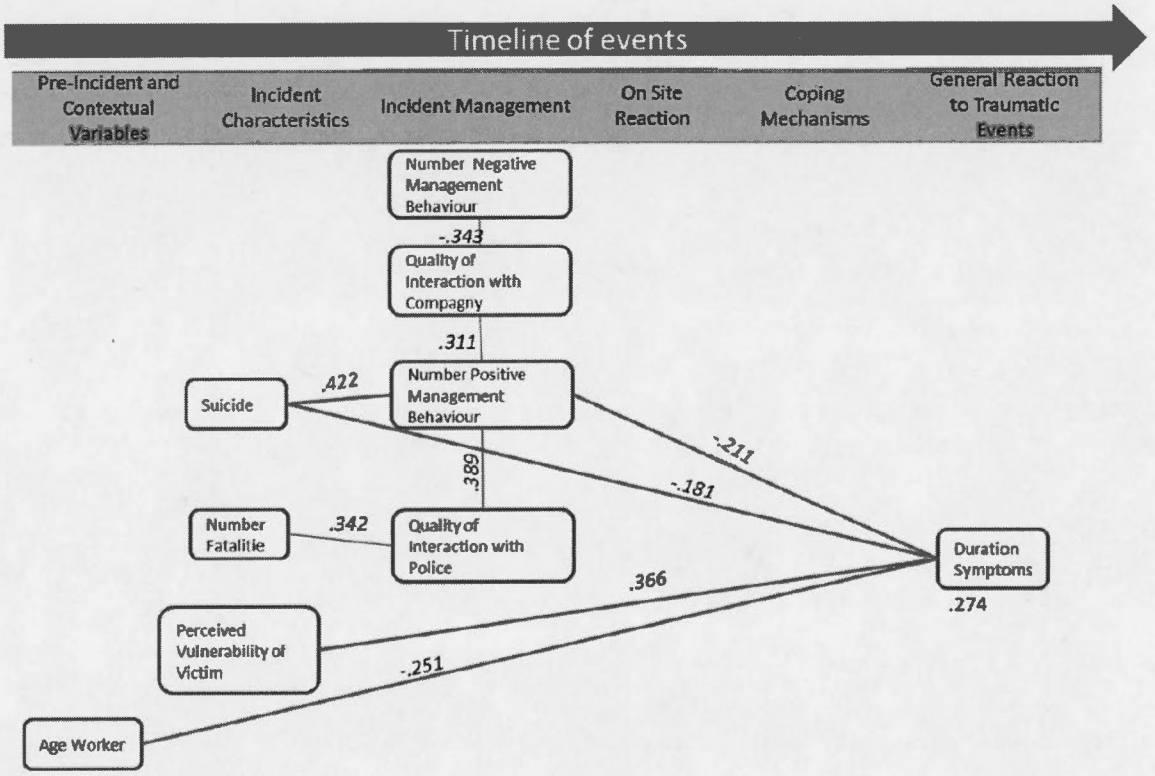


Figure 4. Pathway Analysis on Duration of Symptoms

Figure 5 – Pathway Analysis on No or Limited Impact

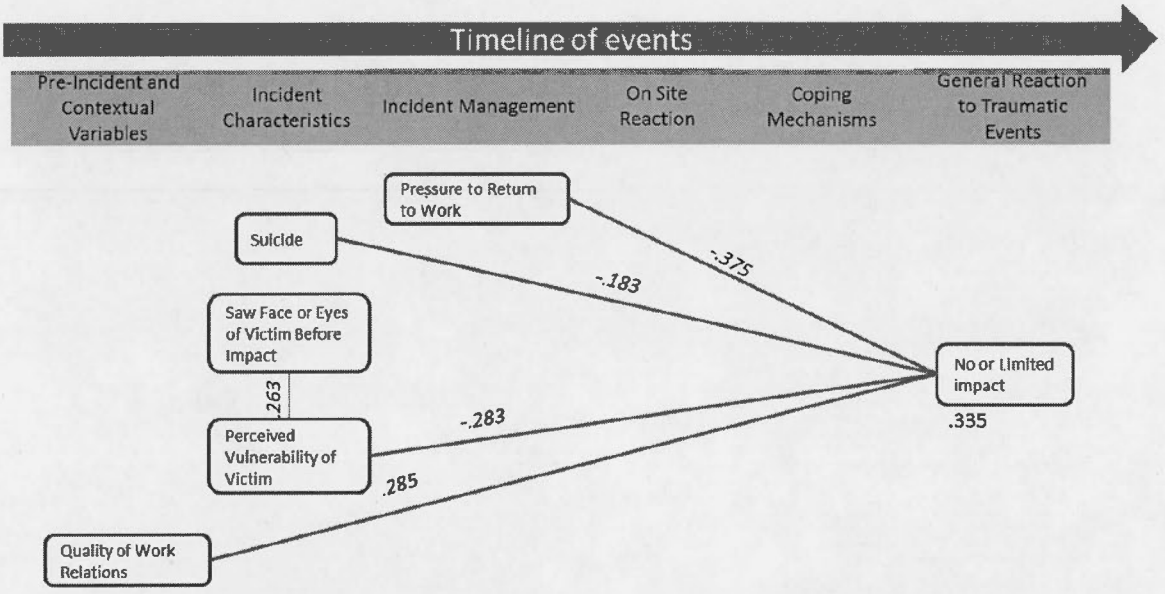


Figure 5. Pathway Analysis on No or Limited Impact

CHAPITRE III

ARTICLE DEUX

# SYSTEMATIC REVIEW OF THE IMPACT OF CRITICAL INCIDENTS ON RAILWAY PERSONNEL

*Cet article a été soumis à la revue Journal of workplace behavioral health*

## 1. Résumé

Ce chapitre (article deux de la thèse) constitue une revue systématique des recherches sur l'impact des incidents graves sur les ingénieurs et conducteurs de locomotive La revue a été faite à partir des bases de données PubMed, Scopus, PAIS, PsychInfo, de « l'open web – google scholar ». Elle vise également à mettre en lumière les points communs et différences entre nos résultats issus de la première phase du projet (article un) et ceux d'autres études.

Elle concerne les études des effets potentiellement négatifs d'être confronté à un incident critique pour les employés ferroviaires. L'état de stress post traumatique apparait après un certain nombre d'incidents (entre 4% et 17% selon les études) mais les effets les plus communs sont des difficultés de fonctionnement (stress augmenté, problèmes d'hypervigilance, de concentration, de sommeil, difficultés psychosociales) qui ne justifient pas un diagnostic de trouble de santé mentale mais qui peuvent affecter profondément les personnes.

## 2. Abstract

Purpose: We present a systematic review of the effects of railway critical incidents on railway personnel. The objective of the review is to provide stakeholders with current scientific knowledge to help understand the effects a critical incident can have as well as risk and protective factors associated with these effects.

Method: This systematic review was done by examining major databases and by a search of unpublished reports in both English and French. A critical approach was applied to analyse the 20 studies.

Results: Traumatic reactions, such as post traumatic stress disorders, sometimes occur after a serious incident. However, the most frequent effects are long term impairments that do not meet diagnostic criteria but can profoundly affect people's daily lives. Risk factors can increase the negative effects of incidents, and these include characteristics of the employee, coping mechanisms, the type of incident as well as support and care received.

Conclusions: The short term effects of critical incidents generally include a range of disturbing symptoms that may develop into Post Traumatic Stress Disorder in a minority of cases, sometimes have no lasting effects, but often include lingering symptoms that are not sufficient for diagnosing a clinical disorder. Prevention programmes and interventions should consider the range of reactions at different stages following the critical incident.

## 3. Key words

railway, workplace, Post Traumatic Stress Disorder; Critical Incident, accident, occupational; trauma prevention; risk factors; suicide

## 4. Introduction

Railway engineers have a high risk of experiencing at least one major incident with injury or loss of life, by suicide or an accident, or a collision involving a risk to their own safety. For example, a U.S study (Margiotta, 2000) found that 75% of train drivers were involved in fatalities during the course of their career. In addition to the engineers who drive the train, other railway workers are involved in critical incidents (CIs), including the conductors who leave the train after a collision with a first aid kit to see if there is a live victim who needs help, the personnel who come to the scene to clean up, as well as the maintenance personnel who have the gruesome job of cleaning body parts from the train. It is impossible to avoid the vast majority of railway collisions and fatalities since once the emergency brakes are activated it can take more than one kilometer before a train can stop. Thus, railway personnel are always at risk of being involved in traumatic and unpredictable CIs, often involving a fatality, and they are generally incapable of doing anything to avoid the event. This makes them particularly vulnerable to adverse post-traumatic difficulties that often need treatment.

## 5. Objectives

This review is structured to answer the following question: What are the effects of railway critical incidents on engineers and conductors and what are the factors associated with the nature and extent of negative impacts? It aims to identify relevant targets for the development of prevention programmes and interventions to provide support and care to train conductors and engineers.

## 6. Method

### 6.1. Research strategy:

We searched the major scientific databases, PubMed, Scopus, PAIS, PsychInfo and the open web for publications in English and French using the following keywords: PTSD, Stress Disorders, Post-Traumatic, Stress, Psychological, Traumatic, Acute; driver*, engineer*, train, railway*, railtrack, rail*, subway*, metro, public transport, underground, locomotive, fatalit*, trauma*, suicid*, trepass*, person under train.
We identified 20 published documents describing the impact of Critical Incidents (CI) on railway and subway drivers.

### *6.2.* Literature review strategy

We included all studies identified but we used standardised criteria to assess the strength of evidence based upon the model of systematic reviews described by Pope, Mays, and Popay (2007). We assessed the level of methodological quality and generalisability of the data provided in the studies. Validity criteria were the clarity of the objectives, the sample and sampling strategy and its fit with the objective, the instruments used, the proposed explanatory models and analysis of risk and protective factors.

### 6.3. Incidents included in the review

In the context of this review, we included studies exploring all incidents that occur on the tracks when the employees involved thought a life was in danger. These included collisions with pedestrians or vehicles, intentional or accidental, major derailments, major close calls when a collision almost occurred and cases of found bodies on the railway property. This large inclusion criteria was justified because we wanted to

explore and compare the effects of various incidents that reflect the variety of situations encountered by employees during the course of their careers. In the review we refeedr to these events as Critical Incidents (CI) unless results related only to a specific type of incident (such as suicides).

### 6.4. Included Studies

Between 1986 and 2013, 20 studies have been published about the impact of CIs on train and metro drivers and on their prevalence, as well as factors associated with the impact of a CI (see Table 1).

*Insert Table 1 about here*

## 7. Results

### 7.1. Effects immediately after the incident (first few days)

The three prospective studies that assessed the impact upon train crew members within a few weeks after a fatality (Cothereau et al., 2004; Limosin et al., 2006; Malt et al., 1993), found high immediate levels of stress. In a Swedish sample of 101 train crew workers involved in a major accident, one third had an acute psycho-physiological stress reaction, such as rapid heartbeat, tremor, restlessness or shaking (Malt et al., 1993). In a French sample of 202 train drivers, Cothereau (2004) found a small number of crew members (4%) to have PTSD symptoms just after the incident. Drivers who experienced a person under train (PUT) incident scored higher on the General Health Questionnaire than those who did not have a PUT incident. When comparing the 202 drivers with PUT incidents and 186 drivers without (Cothereau, 2004), particularly on the anxiety, sleep and social disturbance scales (Limosin et al.,

2006), Cothereau (2004) showed low psychological functioning on the Global Assessment of Functioning. Approximately one third (31%) "felt unable to face the situation" (Limosin et al., 2006). In response to these acute stress reactions, 24% of drivers were prescribed psychotropic drugs and 68% took time off work (Limosin et al., 2006). Usually, people took off less than a week; the average was 4.4 days according to Cothereau (2004). However, despite the fact that these symptoms were observed in a fairly large proportion of drivers, 95% of interviewees were evaluated as being fit to work a few days after the incident (Cothereau, 2004).

Abbott et al. (2003) found that after a PUT incident, train personnel (drivers and police officers) experienced shock, numbness and horror, especially at night when waiting alone in the dark. They also felt anger at being drawn into a situation they did not choose and at the poor handling of the situation by management and emergency services.

Our retrospective study in a Canadian sample of 40 train crew members (Bardon & Mishara, 2014) found intense short term reactions after a fatality. We observed many symptoms related to an Acute Stress Disorder (ASD), such as reliving the event, trying to avoid situations related to the event, and signs of anxiety. We often observed feelings and thoughts such as feeling responsible, guilty, angry, in disbelief, detached and emotionally numb. These symptoms and feelings were not sufficiently intense and diverse to result in a diagnosis of ASD, but they were experienced as troublesome and tended to last for several days or weeks. One quarter of their sample reported no specific reactions after an accident. However, when the incident was a suicide, 40% reported a mild stress reaction and 60% reported an intense stress reaction.

## 7.2. Short term effects – the first month after the incident

Four prospective studies obtained information about the impact on train drivers one month after the fatality (Farmer et al., 1992; Karlehagen et al., 1993; Theorell et al., 1992; Tranah & Farmer, 1994; Tranah et al., 1995). Three of the four studies concerned subway drivers (Farmer et al., 1992; Theorell et al., 1992; Tranah et al., 1995). The studies found that responses varied greatly among drivers. In a case study of three London subway drivers involved in a suicide, acute symptoms were still present and PSTD was diagnosed a month after the suicide (Tranah et al., 1995). According to Farmer et al. (1992) in England, 16% of a sample of 43 London subway drivers involved in a PUT were diagnosed as suffering from PTSD. However, it is important to note that, although they did not have enough symptoms to be diagnosed as suffering from PTSD, this study found that an additinal 37% of drivers had six PTSD symptoms or more, one month after the incident (Farmer et al., 1992). In the study by Farmer et al. (1992), during this one month period, 27% of those who were not diagnosed with PTSD started to show symptoms of depression and phobia. Theorell et al. (1992) found in a sample of 49 Swedish subway drivers that if phobia and depression symptoms were present during the first month, the risk was higher that these drivers would have to take long term leave (more than three months).

In a study of 101 train drivers in Norway and Sweden, Karlehagen et al. (1993) found great diversity in the train drivers' symptoms one month after a major incident causing injury or death. The most common effects observed were a lower threshold for stress reactions and sleep disturbances. They found that after a month, the more intense psychological symptoms tended to subside and the symptoms of intrusion of disturbing thoughts and avoidance of stressful situation or reminders of the event tended to diminish.

Our recent investigation (Bardon & Mishara, 2014) showed that those who still had symptoms one month after the event were more likely to experience long term negative effects than those who did not. A minority (17%) were diagnosed with PTSD at least once in their career. Even if they were not diagnosed, many interviewees experienced symptoms that, although not sufficiently intense to warrant a clinical diagnosis, are associated with PTSD and other mental health problems. These symptoms included Agitation (80% of cases), Disturbed Functioning (28%), Anger (47%) and Intense Fatigue (5%).

### 7.3. Mid-term impact – three to six months after the incident

Three studies considered the period of three to six months after the incident (Cothereau, 2004; Limosin et al., 2006; Tranah et al., 1995). In their case study of three London Subway drivers, Tranah et al. (1995) found that suicides continued to have a negative effect on drivers after three months, but the impact was generally not so severe that a psychiatric diagnosis of depression or PTSD could be made using standardised instruments (General Health Questionnaire, Impact of Event Scale and PTSD interview). Although the intense psychological symptoms had generally stopped by six months, higher than normal levels of tension remained. Limosin et al. (2006) found that Acute Stress Disorder symptoms generally disappeared six months after a PUT. Mishara and Bardon (2013b) found that in 40% of crew members reported mild reactions six months after the incident, including flashbacks, dreams, hypervigilance and generalized anxiety.

### 7.4. Long term effects and general effect

Briem et al. (2007), in a study of 16 train drivers in Sweden who had been involved in a PUT incident, described the most common effect of train accidents as "long term,

low key PTSD". They found that these effects were not sufficiently intense to meet the criteria for a diagnosis of PTSD or Depression, but nonetheless, they had a significant impact on the lives of crew members (Briem et al., 2007; Limosin et al., 2006; Tranah et al., 1995). If clinicians, regulators and employers limit their appraisal of negative consequences to symptoms that are severe enough to make a psychiatric diagnosis, these important long term negative consequences may be overlooked.

In most cases, the reduction in symptoms continued one year after the incident and returned to the levels observed in colleagues who did not have a PUT (accident or suicide, with or without fatality) (Cothereau et al., 2004; Karlehagen et al., 1993; Theorell et al., 1992). However, these symptoms may continue to have an important impact upon the lives of some drivers. For example, 3% of drivers were still taking psychotropic drugs a year after the incident (Limosin et al., 2006), PUT drivers took more time off (on average 9.17 days) than their colleagues (average 4.60 days, Limosin et al., 2006) and 5% still scored high on the General Health Questionnaire (Karlehagen et al., 1993).

When asked what the worst aspects of their work were, 36% of train drivers answered that it was the anxiety they felt about the risk of train fatalities (Austin & Drummond, 1986). This anticipatory anxiety could induce higher than normal baseline stress levels and general tension.

Retrospective studies also showed that major incidents (involving injury or death) generally had a high impact on drivers. Drivers involved in a major incident had a high score on the Impact of Event Scale (IES), which measures the subjective stress level associated with a specific event (Meier et al., 1998; Vatshelle & Moen, 1997). However, in some instances train-related traumas impacted people less than traumatic events in their personal lives, such as the loss of a close relative or friend, divorce or an accident (Meier et al., 1998).

It was widely noted that fatalities generally had a strong impact on drivers. In a survey by mail with 236 New York railway engineers, Margiotta (2000) found that rail engineers who had a PUT felt distress associated with the event itself, but also concerning the proceedings following the event (reports, trials, passing by the same spot). They experienced a large variety of intrusive effects such as anger, depression, ignoring feelings, consuming alcohol (33%), drugs and medications (9%), self-blame, blaming the company, blaming God, lashing out, withdrawal, flashbacks (65%) and increases in general stress level.

Abbott et al. (2003) observed that several months after the incident, drivers felt anxiety when working on the same route, especially when symbols of grief were present at the site (such as a cross or marker placed by the family of the deceased). They often had flashbacks. They could think about the incident every day and experienced loss of sleep for several weeks.

Briem et al. (2007) found that drivers generally did not feel that their work was affected, but they felt tenser on the job. The events were permanently etched in their memory. They often had flashbacks (thoughts of what happened just before the incident, who relieved them and who were the peers who came to see them). They usually felt that the event stayed with them for a long time. PUT incidents had important long term effects, beyond acute stress and PTSD. Drivers had fewer resources and coping skills and a lesser sense of coherence even years after incidents than those who did not experience PUT. They thought of themselves as accident prone and they felt less involved in their personal lives. They were preoccupied by their health, blunted emotionally, insecure in their social relationships, their well-being and experienced a lower overall level of health (Briem et al., 2007).

Overall, when we group all cases of PTSD from the various studies that indicated clearly the number of persons with this diagnosis, we can observe that in the 630

railway employees who have been assessed after a CI, 128 were diagnosed with PTSD. This crude calculation gives us an overall rate of PTSD of 20.3% in railway employees after a work related CI.

### 7.5. Cumulative effects

We considered cumulative effect when drivers were confronted with more than one CI and the impact of previous incidents changed the reactions to the following ones. Information on cumulative effects has not always been gathered and the impact of being involved in repeated events was not always described the same way. There were two distinct interpretations of the effect of having experienced more than one incident:

First, experiencing more incidents could induce higher levels of distress. Austin and Drummond (1986) found in an Australian sample of 562 urban train drivers that drivers who experienced previous fatalities anxiously anticipated future incidents to occur and these expectations were one of the most important stressors in their work. A Norwegian and Swedish sample of 101 train drivers found that drivers who had more than one PUT had stronger negative long term consequences (Karlehagen et al., 1993). They also found that being worried in advance about the possibility of a fatality increased the likelihood of a negative impact. Vatshelle and Moen (1997), in a sample of 830 Norwegian drivers, found that train drivers who had more than one CI during their career had more health problems. Margiotta (2000) reported that 60% of drivers who had previous PUT experiences felt that they were not prepared for the one they just experienced. But the majority said that they now felt better prepared for those to come. In Korea, Yum et al. (2006) noticed that the more incidents drivers had, the higher the risk for a diagnosis of PTSD. Finally, Briem et al. (2007) noted that sensitivity to the negative effects of incidents could increase with the number of incidents, but

not with everyone. However, they did not provide information on why some people were more affected by several incidents than others.

The alternative perspective was that the experience of more incidents helped desensitize drivers to the traumatic aspect of the events. Farmer et al. (1992) and Malt et al. (1993) noticed that the presence of previous incidents did not seem to affect the reaction to the last incident. Margiotta (2000) also found that the level of distress was generally higher for drivers confronted with their first PUT incident and lower for those who had two or more.

Results from the qualitative study by Mishara and Bardon (2013b) show that an accumulation of events can play an important part in the life of crew members. The average number of CIs in their participants was 4.5, ranging from 1 to 22. The majority of participants had cumulative negative effects. The more incidents they experienced, the more difficult they felt it was to return to normal. However, some participants said that previous incidents taught them how to act and react, or that incidents hardened them or that they managed to consider them one at a time. Of the people who developed PTSD, a majority did so after a second or subsequent incident (5 of the 7 cases of PTSD). This was in contradiction with findings from Brunet, Boyer, Weiss, and Marmar (2001). Cumulative effects in the Mishara and Bardon (2013b) study included subtle changes in mood, changes in outlook on life, flashbacks, edginess, fatigue, longer recovery periods and counting the days until retirement. Although none of these changes were diagnosed problems or illnesses, these changes were important for the individual, but were difficult to quantify and observe using tools for diagnosing mental disorders or physical illness. They have rarely been taken into account in impact studies. Further investigations would be useful to better understand their significance.

### 7.6. Train suicides versus train accidents

Very few of the studies made a distinction between the effects of suicides and of accidental deaths, and the effects of non-fatal incidents and close calls have rarely been investigated. Briem et al. (2007) found that suicides are usually less difficult to understand because one could rationalize that the victim intentionally caused the fatality. However, this ability to explain or understand the incident did not prevent most drivers from feeling guilt and anxiety. In our study of Canadian employees, we found that suicides induced more intense reactions of anger (short and long term) and accidents more feelings of helplessness (Bardon & Mishara, 2014). Accidents and suicides may induce different reactions based upon the crew member's understanding of the intent of the victim, the avoidability of the incident and their ability to make sense of what happened.

### 7.7. Risk and protective factors

Several research investigations identified factors that could increase or mitigate the traumatic reactions:

Personal characteristics, such as age, family situation, level of spirituality or seniority did not predict the intensity of stress reactions to a PUT (Margiotta, 2000). However, social support provided by family members somewhat reduced the intensity of the stress reaction (Abbott et al., 2003).

Suppression of emotions proved to be a poor coping strategy for train crews, since it prevented the driver from dealing with the emotional toll of the event and could induce long term poor coping strategies, such as binge drinking, using medication or drugs (Abbott et al., 2003). However, avoidant coping could reduce the risk of mental health problems when employees deliberately limited their exposure to reminders and to the vulnerability of victims (Bardon & Mishara, 2014).

Resilience and humour, coping strategies such as talking, using support, counseling, peer support and previous experiences reduced the effect of PUT incidents (Abbott et al., 2003).

The perceived vulnerability of the victim (Bardon & Mishara, 2014) and direct contact with the corpse (Briem et al., 2007) are likely to increase distress.

In a recent study, Briem et al. (2007) explored the effect that preoccupations with a possible fatality had on drivers. The authors identified three important variables in driver's minds for predicting the intensity of difficulties they experienced after a fatality: their estimated number of small incidents during the year before the major incident, their estimate of the probability of having an accident in the coming year and their estimate of their accident proneness. The more drivers felt they were likely to have an accident, the harder it was to recover when they had one. This confirmed findings from Austin and Drummond (1986) who found that the anxiety about the potentiality of a train accident was one of the most important stressors for train crew.

The experience of a fatality could be seen as having different effects on the way train crews reacted to incidents in general. Meier et al. (1998), in a study of 342 US railway employees, did not find a difference between the effect of fatalities and other stressful events (associated with or not related to professional life). In their study of 111 railway engineers in New England, Napper (1998) found that fatalities were more traumatic than non-fatal incidents. Margiotta (2000) found that in New York State engineers, acute stress was still present in 77% of those who had a PUT up to 10 years after the incident. However, they did not indicate if the incidents with a fatality had more negative effects. In some studies (Malt et al., 1993; Theorell et al., 1992), only fatalities were included in the analyses, while other studies showed that effects could be strong, whether there was a fatality or not (Margiotta, 2000; Meier et al., 1998).

This suggested that when planning for post-incident follow-ups, one should consider the fact that close calls and injuries could also have a strong negative long term effect on drivers and this should be taken into account in post incident management. The amount of injury to the victim was also a risk factor for increased trauma (Briem et al., 2007).

Post incident support from the employer had important benefits. Research studies showed that the lack of accompaniment from the employer and medical services (Cothereau, 2004) and poor incident management (Bardon & Mishara, 2014) were strongly linked to negative effects of incidents.

### 7.8. Specificities of railway critical incidents

It is important for prevention purposes to know if reactions to railway CIs are similar to reactions to other fatalities and CIs. Although there are certainly some commonalities with other types of work related incidents, railway CIs have very specific characteristics that may warrant the development of specialized preventive and intervention strategies. In comparison with other types of incidents, railway CIs are different in that:

- Driving a train is one of the situations where workers can injure or kill somebody while carrying out their normal daily work (Austin & Drummond, 1986; Tranah et al., 1995). Other workers are rarely in the situation of train drivers who can feel that they are contributing to somebody else's death (Austin & Drummond, 1986; Cothereau et al., 2004; Vatshelle & Moen, 1997)
- Near misses constantly remind drivers of the possibility of a fatality (especially when involving maintenance crew, Austin & Drummond, 1986)
- Incidents occur suddenly, without warning and at a high speed (Malt et al., 1993; Vatshelle & Moen, 1997)

- Drivers have no possibility of avoiding a collision. They are in a situation of extreme helplessness (Malt et al., 1993; Theorell et al., 1992; Vatshelle & Moen, 1997).
- Train drivers may see the victim alive prior to impact and make eye contact. Seeing somebody be killed is a recognized source of trauma (Malt et al., 1993)
- Railway crew have to act as first responders in incidents in which they are also victims (Bardon & Mishara, 2014)

For all the above reasons, railway CIs have specificities which make their impact upon workers difficult to compare with other types of incidents that workers may experience. Therefore, support and intervention protocols developed for other workers who may be involved in fatalities, such as police, firemen and the military, may not be easily transposable to railway workers.

8. Critical Analysis of Studies on the Impact of Critical Incidents

Several different types of events using different terminology have been described and analysed. This reflects the variety of events that railway crew members may experience while working, but it also indicates a lack of consensus on what constitutes a serious railway CI that needs support and treatment. Events described and included in the review are:

- Person Under Train (PUT) describes collisions with individuals, without vehicle involvement and without indication of whether or not the event is a suicide or an accident, and including both fatal and non-fatal incidents (Cothereau, 2004; Limosin et al., 2006; Margiotta, 2000; Mehnert et al., 2012; Theorell et al., 1992; Yum et al., 2006).
- Suicide. Some studies limit their analysis to incidents that are clearly identified as suicides, although there are generally no indications of the

method used to classify these events as suicides (Abbott et al., 2003; Farmer et al., 1992; Karlehagen et al., 1993; Malt et al., 1993; Tranah & Farmer, 1994).

- Serious incident on tracks (or "work related traumatic and stressful events or negative experiences") include PUT, vehicles hit on the tracks and derailments (Jo et al., 2010; Meier et al., 1998; Napper, 1998; Vatshelle & Moen, 1997).
- Critical incidents (CI) are described as events experienced at work that resulted in fear, helplessness and horror (Garrison, 2000). This approach identifies a CI by its consequences and not by objective criteria concerning the nature of the event.
- One may also consider all events that involve a third party: accidents, suicides, injury or deaths, with or without a vehicle, close calls where collisions almost occurred and found bodies on the railway property. This category of events includes events unrelated to hitting a person (such as derailments or injuries with equipment) that intrude upon a normal day's work and may place the crew members in a situation of being a victim and a part of the incident of its management (Bardon & Mishara, 2014).

These variations indicate the need to standardise descriptive and research practices in this area. Different types of incidents may have different impacts, but comparisons as well as meta-analyses are difficult because of a lack of standardised definitions.

Most of the studies are retrospective investigations in which train crew members are asked to remember traumatic events that took place in a more or less distant past. The advantage is that this method allows for a more in-depth understanding of the lifelong impact of train fatalities. When the study involves interviews or open-ended questionnaires about the effects, they may help identify more subtle reactions than

when using standardised instruments (Bardon & Mishara, 2014; Briem et al., 2007; Margiotta, 2000). However, the weakness of retrospective studies is that it is difficult to accurately describe the process of the development of symptoms at various points of time after the incident. Also, since they rely upon recollections of past events, there is a possibility of biased responses, particularly concerning events that occurred many years before. In prospective studies, data collection usually starts immediately after the incident and can continue at specific intervals for several years (Cothereau, 2004; Malt et al., 1993; Mehnert et al., 2012; Theorell et al., 1992). Prospective studies allow for more comprehensive analyses of reactions at the different stages post-incident as they unfold. However, they may not be sensitive to the role of an accumulation of events and long term effects of CIs. These approaches are complementary and bring different levels of understanding to the effects of CIs on railway employees and both should be considered as valuable research strategies to assess the effects of railway and other potentially traumatic events.

Studies used both in house and standardized questionnaires. Several studies used similar instruments and variables, which has the advantage of allowing for qualitative comparisons of their results (for example, Impact of Event Scale or General Health Questionnaire). However, many of these instruments cover only a limited range of symptoms. For example when the negative impact is defined as being present only when the symptoms meet diagnostic criteria for a mental disorder, such as Post Traumatic Stress Disorder (PTSD), other reactions that have important consequences for the worker are ignored, such as fatigue, irritability and psychosocial withdrawal. Other studies are based on semi-structured interviews (bardon & Mishara, 2014; Briem et al., 2007) and offer a more detailed in-depth analysis of the variety of effects experienced by employees. Differences between studies in their choice of

instruments may partly explain differences between studies in the observed incidence of PTSD and other mental health problems.

Studies have used varied types of sampling strategies that make their samples more or less representative of the general population of railway workers. The most common sampling strategy for retrospective studies is to systematically send a questionnaire to all members of an organisation (through the union or the employer). In prospective studies, the sampling generally involved systematically contacting employees after a CI over a period of time. When available, data on the extent that the samples are representative of the workforce are presented (see Table 1).

Recruitment strategies could play a key role in representative participation and the quality of the results. In retrospective studies, questionnaires were sometimes sent to all members of a railway union (Margiotta, 2000; Napper, 1998), and sometimes to all employees without mention of the union (Austin & Drummond, 1986; Garrison, 2000; Jo et al., 2010; Vatshelle & Moen, 1997). Systematic recruitment through employers seems to have induced higher participation rates than via the unions. It is difficult to interpret these variations. Prospective studies with employees recently involved in CI have very high rates of participation.

Recall bias in retrospective studies is a concern that has been addressed by researchers. Cross sectional retrospective studies usually evaluate the effect of past events on current health. Therefore recall bias is reduced, since the accuracy of the memory matters less than the current impact of the event (Vatshelle & Moen, 1997; Yum et al., 2006). Other retrospective studies consider the impact of separate events without associating them with current health status (Bardon & Mishara, 2014; Kim et al., 2012; Margiotta, 2000; Napper, 1998), thus inducing potential problems of recollection. These two strategies reach similar conclusions about the type, incidence

and scope of negative effects of CIs, thus validating the relevance of these different methods.

The general quality of the studies we identified is satisfactory for our objective, although generalisation may not always be easy because of small samples (Abbott et al., 2003; Briem et al., 2007; Neary-Owens, 2001; Tranah et al., 1995) or the specific groups involved (Garrison, 2000). However, findings are consistent between studies on the different types of effects CIs can have on railway employees.

There are no population based epidemiologic studies to assess the scope of the involvement of railway employees in a CI. There are very important variations in the samples studied so far, ranging from 4% of employees involved in a CI (Jo et al., 2010) to 55% (Meier et al., 1998), 73% (Napper, 1998). These differences may be due to cultural factors, variations in railway suicide incidence, network characteristics (density of traffic or of population) or recruitment bias. Some employees may decide not to take part in studies because they do not want to be reminded of CIs, and some may want to participate to make sure their experience is known. These biases are impossible to verify. The fact that all studies are based on local samples makes it difficult to extrapolate national or international trends in the numbers of railway employees affected by CIs.

## 9. Conclusion

This review has been limited to publications and other documentation sources in English and French. Because of the varied levels of quality of research reported and differences in definitions of events and outcome variables, there are many gaps in our knowledge.

Meta-analysis method could not be applied to the studies included because of the small sample sizes and wide discrepancies in the types of iincidents and data

collection methods.Research indicates that recovery is the normal result after a railway CI. People usually get better after a while, whether there was an intervention or not, usually within a year or so (Theorell et al., 1994), but quite often within a few days (Cothereau, 2004). The incidence of PTSD is relatively low (between 2%, Jo, 2012 and 17%, Bardon & Mishara, 2014). However, many studies describe a wide range of pervasive effects that may hinder the workers' ability to cope in the long term and render them more sensitive to the cumulative effect of involvement in multiple incidents. One of the critical questions remaining to be resolved is what constitutes an acceptable level of recovery. If we consider that a reduction of symptoms below diagnostic criteria is indicative of recovery, we ignore the significant impacts of sub-threshold symptoms, which can seriously compromise the quality of life of workers. The ability to work is usually considered as a sign of recovery (Mishara & Bardon, 2013b). However, recovery is different from fitness to work. Many drivers feel pressurised to return to work or experience increased stress levels and fatigue when they are back (Mishara & Bardon, 2013b). This issue of recovery versus fitness to work needs to be addressed by mental health professionals, railway management, workers compensation boards, unions and researchers, in order to define proper assessment strategies and intervention protocols.

Railway medical rules and workers compensation boards base decisions on diagnosed consequences such as PTSD, depression or anxiety. However these effects are not the most frequent outcomes after a CI. The offer for help, care and treatment also often depends on these diagnoses and workers who experience important effects on their lives but which are not sufficient to meet diagnostic criteria may not receive the help they need.

Cumulative effects of CI and delayed onset on traumatic reactions have been documented in several of the studies reviewed, but the conclusions are contradictory.

It is necessary to improve our understanding of the impact of multiple involvements in a CI by improved criteria and indicators to define the incidents and assess their effects.

Railway CIs do not have a uniform effect on employees. It is important for employers and support providers to identify the specific impact of these work related events on individual workers as well as related risk factors in order to offer appropriate help.

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Table 1
Studies of the Impact of Railway Critical Incidents(CIs) on Railway Workers

| Authors | Country Region | Population | Sample Size | Objectives of the study | Sampling method and representativity | Research design and methodology | Delay between incidents and data collection | N with PTSD | Main findings on the impact of railway CI |
|---|---|---|---|---|---|---|---|---|---|
| Abbott, 2003 | UK | People involve in incident (5 drivers, police, witnesses) | N= 18 | Describe the general effects of railway suicides | Theoretical sample<br>Saturation of data<br>No indications of representativity | Retrospective<br>Interviews<br>Qualitative<br>Case study | No indication | Not indicated | Reactions on site: Shock, numbness, horror especially at night, have to wait alone in the dark<br>Long term effects: anxiety when working on the same route, flashbacks, loss of sleep for a few weeks, anger, fear of loss of income and job |

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|---|---|---|---|---|---|---|---|---|---|
| Austin and Drummond, 1986 | Australia Sydney | Suburban train drivers | N = 562 | Incidence of various work related stressors | Questionnaire sent to all employees in the area (632, 89% participation) Sample representative of railway employees | Retrospective Questionnaire | Incidents in career | Not indicated | 1/3 had at least one fatal incident in career<br>Anxiety about train fatalities was rated as the worst aspect of the job (36% the most serious problem)<br>No assessment of short and long term effects of fatalities on drivers |

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|---|---|---|---|---|---|---|---|---|---|
| Bardon and Mishara, 2013 | Canada | Train Engineers and Conductors | N=40 | Describe general effects of railway fatalities, injuries and Close Calls | Recruitment via union and employers<br>Sample representative on age, gender and seniority | Retrospective Interviews | Incidents in career | N=7 | PTSD: 17%<br>Mental health problems (depression, anxiety, phobia): 19%<br>Non diagnosed reactions were: agitation (80%), disturbed functioning (28%), anger (47%) and fatigue (5%)<br>Duration of negative effects varies greatly and 3 crew members never returned to work after a CI |

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|---|---|---|---|---|---|---|---|---|---|
| Briem et al., 2007 | Sweden | Train drivers | N=16 Including 6 drivers who experienced a PUT | Describe reactions and risk factors after a PUT | No indication of sampling method | Retrospective interviews and questionnaires Comparison group: serious accident | Incidents in career | Not indicated | Observed reactions: depression, anxiety, PTSD, intrusion, avoidance, hyper-activation, increased tension and flashbacks Cumulative effects vary |

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| Authors | Country Region | Population | Sample Size | Objectives of the study | Sampling method and representativity | Research design and methodology | Delay between incidents and data collection | N with PTSD | Main findings on the impact of railway CI |
|---|---|---|---|---|---|---|---|---|---|
| Cothereau et al. 2004 and Limosin et al., 2006 | France | Train drivers | N=202 involved in PUT, N=186 without PUT | Describe the course of psychological reactions after a PUT | Recruitment throughout the national railway network | Longitudinal prospective interviews and questionnaires Experimental design with matched control group | Interview immediately after PUT, 3 months, 1, 2, 3 years after | N = 8 | 80% of CI were suicides<br>4% crew had symptoms of PTSD immediately after CI<br>95% were fit to work in the following days and remained fit to work over time<br>All symptoms receded with time to attain control group level at year3<br>Longer term effects were associated with lack of accompaniment post CI and presence of other stress factors |

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| Authors | Country Region | Population | Sample Size | Objectives of the study | Sampling method and representativity | Research design and methodology | Delay between incidents and data collection | N with PTSD | Main findings on the impact of railway CI |
|---|---|---|---|---|---|---|---|---|---|
| Farmer et al. (1992) | England London | Subway drivers | N=43 | Describe incidence of Psychological reactions after a suicide | Recruitment throughout the metro network | Prospective Interviews Standardized instruments | within one month after suicide | N=7 | PTSD was present in 16%<br>23% had another mental health diagnosis (depression, phobia)<br>61% had no diagnosis but took an average of 9.1 days off work<br>37% of sample scored more than 6 symptoms in the PTSD check-list (below cut-off point, but still high)<br>Only 4 reported that they suffered no effect of incident |

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| Authors | Country Region | Population | Sample Size | Objectives of the study | Sampling method and representativity | Research design and methodology | Delay between incidents and data collection | N with PTSD | Main findings on the impact of railway CI |
|---|---|---|---|---|---|---|---|---|---|
| Garrison, 2000 | USA | Light rail operators | N=69 | Describe the incidence and general effects of CI | All workers in the are received a questionnaire (111, 62% participation) Sample is representative of all workers Incident and Non incident groups were comparable | Retrospective Questions | Incidents in career Mean: 2.9 years between CI and questionnaire | N=7 | 46% had traumatic events 10% PTSD High levels of stress for close calls when employee had a CI before |

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| Authors | Country Region | Population | Sample Size | Objectives of the study | Sampling method and representativity | Research design and methodology | Delay between incidents and data collection | N with PTSD | Main findings on the impact of railway CI |
|---|---|---|---|---|---|---|---|---|---|
| Jo, 2010 and KIM, 2012 | Korea | Subway drivers | N=827 | Study of work related negative experiences | All workers in the area received the questionnaire (961, 86% participation) No indication on representativity | Retrospective questionnaire | Variable | N=4 | 39 (4%) had a accident resulting in death or serious injury Mild incidents were more likely to be related to depression PTSD: 2% Panic disorder: 13% Drivers with PUT had 4.2 more probability to have a panic disorder and 4.4 more probability to have lifelong PTSD |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Malt et al. 1993<br>Karlehagen et al. 1993 | Norway and Sweden | Train drivers | N=101 | Describe the course of psychological and physiological reactions after a suicide | Recruitment through the railway network<br>124 employees were contacted (81% participation)<br>Sample is representative of train drivers | Prospective Longitudinal study<br>Standardised questionnaires | Immediately after, one and 12 months after CI | Not indicated | Immediately after incident: 1/3 had acute psycho-physiological stress response , sleep disturbance, intrusion, avoidance or flashbacks<br>One month later: important reduction of symptoms for most participants. Persistence of increased arousal and sleep disturbance.<br>12 months later: predictors of long term effects are previous CI, being worried in advance about the consequences of fatalities, a high short term intrusion score and the association of other negative events |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Margiotta, 1999 | US New York | Railroad engineers | N=236 | Describe the incidence and effects of PUT | All current members of a railway union and retired engineers<br>664 questionnaires sent<br>35% participation<br>No indication on representativity of sample | Retrospective questionnaire by mail | Variable | N=19 | 75% (N=177) had a PUT (89% were fatalities)<br>552 incidents reported in the survey<br>Large variety of reactions were described: anger, depressed, ignoring feelings, using alcohol (33%), drugs and meds (9%), blame self, company, god, Lashing out - withdraw, flashbacks (65%), high stress scores<br>PTSD: 11%<br>Most intense reaction receded after 3 days. Distress levels were increased by connected tasks and situations, such as producing a report, being involved in a trial or working the same route and is |

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| Authors | Country Region | Population | Sample Size | Objectives of the study | Sampling method and representativity | Research design and methodology | Delay between incidents and data collection | N with PTSD | Main findings on the impact of railway CI |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | higher for first incident |
| Mehnert 2012 | Germany | Train drivers | N=73 | Describe the course of traumatic reactions in crew members diagnosed with PTSD after a PUT | Recruitment of patients in a treatment programme No indication of sampling or representativity | Prospective questionnaires | Incidents took place within 6 months for 65% of sample and within 3 years for 22% At beginning of treatment, at the end of treatment, 6 months after | N=73 | On average patients had 1.8 CI |
| Meier et al. 1998 | USA | Railway employees | N=342 Including 188 with a traumatic event | Description of incidence of various traumatic and stressful events (personal and work related) and analyse of the differential effects of these incidents | Attendees to a railway conference were identified and questionnaires were sent to them | Retrospective study by questionnaires by mail | Mean: 4.9 years between incident and questionnaire | Not indicated | 72 (38%) had railway related CI and 188 described having a CI in other areas of their life Work relate CI had lesser negative impact than others |

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Studies of the Impact of Railway Critical Incidents(CIs) on Railway Workers

| Authors | Country Region | Population | Sample Size | Objectives of the study | Sampling method and representativity | Research design and methodology | Delay between incidents and data collection | N with PTSD | Main findings on the impact of railway CI |
|---|---|---|---|---|---|---|---|---|---|
| Napper, 1998 | USA New England | Railroad engineers | N= 111 | Describe the incidence and effects of railway accidents | 270 employees members of a railway union received a questionnaire(41% participation) | Retrospective questionnaire by mail | Variable | Not indicated | 73% had a CI<br>Mean of 1.3 fatalities per person and 2.8 serious incidents<br>They had more psychological difficulties than general population and fatalities induce more symptoms of psychological distress than other incidents |
| Neary-Owens (2001) | USA | Train drivers | N=30 | Describe effects of railway traumatic events | Theoretical Snowballing sample among members of a railway union<br>No indication on representativity | Retrospective interviews | No indication | Not indicated | Various levels of emotional disequilibrium were observed but low levels of PTSD<br>Anger (1/5) and Guilt (1/6) were the most commonly observed feelings |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Theorell et al., 1992 | Sweden Stockholm | Subway drivers | N = 49 | Describe the course of psychological and physiological reactions after a PUT | Systematic recruitment when PUT occurred<br>80 cases (61% participation) | Prospective Longitudinal Experimental design (matched control group of drivers without a PUT: 49) | Interview and blood tests 3 weeks, 3 months, 1 year after event | Not indicated | Drivers with PUT took more leaves of absence (38% more than one month off between 3-12months post incident)<br>Smoking and alcohol use, blood pressure and testosterone were not affected by incident<br>Prolactin was higher at all measures<br>When Cortisol levels, depression and Phobia were higher at 3 weeks, drivers were likely to be off work for a longer period of time<br>Sleep disturbance was more intense at 3 weeks<br>When the victim was severely injured, the driver was off work for a longer period of time |

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Studies of the Impact of Railway Critical Incidents(CIs) on Railway Workers

| Authors | Country Region | Population | Sample Size | Objectives of the study | Sampling method and representativity | Research design and methodology | Delay between incidents and data collection | N with PTSD | Main findings on the impact of railway CI |
|---|---|---|---|---|---|---|---|---|---|
| Tranah and Donnell, 1995 | UK London | London underground | N=3 | Describe the course of psychological reactions after a suicide | No indication on sampling and representativity | Longitudinal case study | Questionnaires at 1 and 6 months after the suicide | N=0 | Reactions do not reach diagnosis levels for PTSD and depression. Psychological problems are present at one month but mostly resolved at 6 months |
| Vatshelle et al., 1996 | Norway | Train drivers | N=830 | Description of incidence and general effects of serious on the tracks accidents | Questionnaire sent to all railway employees in an area 1182 (70% participation) | Retrospective questionnaire by post-incident | Most subjectively distressing incidents took place within 10 years of questionnaire | Not indicated | 392 (48%) had at least one major incident Drivers who had CI presented poorer health than those who had not. There was a cumulative negative effect of CI |

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Studies of the Impact of Railway Critical Incidents(CIs) on Railway Workers

| Authors | Country Region | Population | Sample Size | Objectives of the study | Sampling method and representativity | Research design and methodology | Delay between incidents and data collection | N with PTSD | Main findings on the impact of railway CI |
|---|---|---|---|---|---|---|---|---|---|
| Yum et al., 2006 | Korea | Metro and train drivers | N=639 | Describe the general effects of a PUT | All employees of several subway lines 800 (79% participation) | Rétrospective Questionnaire | variable | N=3 | 413 (64%) had PUTDrivers with more PUT experiences in the past year had higher risks of PTSD |

CI: Critical Incident; Close Call: instance where a collision almost occurred with a person or a vehicle; PTSD: Post Traumatic Stress Disorder; PUT: Person Under Train Incident

CHAPITRE IV

ARTICLE TROIS

# SYSTEMATIC REVIEW OF INTERVENTIONS TO PREVENT AND REDUCE THE NEGATIVE EFFECTS OF RAILWAY CRITICAL INCIDENTS ON EMPLOYEES

## 1. Résumé

Ce chapitre (article trois de la thèse) constitue une revue systématique des recherches sur les mesures visant à prévenir ou réduire les effets négatifs des incidents ferroviaires critiques. La revue a été faite à partir des bases de données PubMed, Scopus, PAIS, PsychInfo, de « l'open web – google scholar » et a été complétée par une recherche de rapports et documents internes des acteurs du réseau ferroviaire à travers le monde disponibles en anglais et en français. Elle permet également de mettre en lumière les points communs et les différences entre nos résultats issus de la première phase du projet (article un) et ceux d'autres études.

Elle examine les stratégies de prévention et d'intervention ayant été développées pour réduire l'incidence et l'ampleur des réactions traumatiques des travailleurs après ces incidents ferroviaires graves. Nous avons ajouté aux publications scientifiques l'analyse des guides de l'industrie et des protocoles disponibles en place dans diverses compagnies ferroviaires. Ces analyses montrent que les actions préventives devraient être engagées par l'employeur dès que possible après l'incident (dans les heures suivantes si possible) de façon à s'assurer que l'employé est adéquatement soutenu dans son milieu de travail. Une analyse approfondie des études descriptives et évaluatives de ces interventions montre qu'elles ont été rarement évaluées (tant au niveau de l'implantation que des effets). Cependant, il semble que la formation préalable sur les réactions traumatiques potentielles, des interventions empathiques et soutenantes des gestionnaires, la démobilisation systématique, des procédures claires et explicites de retour au travail et des

programmes de soutien par les pairs sont des stratégies prometteuses pour diminuer le risque de développer des réactions traumatiques. Certaines interventions cliniques visant à traiter les employés ferroviaires ayant développé des troubles de santé mentale après un incident critique ont été évaluées et ont montré des effets bénéfiques. Il s'agit du débriefing post-incident, des thérapies cognitives comportementales et de la désensibilisation et retraitement par les mouvements oculaires (EMDR).

## 2. Abstract

Objective: We present a systematic review of interventions to prevent and reduce negative effects of railway critical incidents on employees. The objective of the review is to provide stakeholders with current scientific knowledge to help design support programmes adapted to the railway context.

Method: This systematic review was done by examining major databases and by a search of grey literature in both English and French. A critical approach was applied to analyse the 17 identified studies.

Results: An examination of guidelines and company protocols shows that action should be undertaken by company representatives as soon as possible after a critical incident to insure the employee is properly supported by his work environment. Prior training for crew on potential reactions, caring interventions by managers, systematic demobilisation, explicit return to work policies and peer support are promising strategies to reduce the occurrence of negative effects. Clinical interventions to reduce symptoms that have empirical validation are: post incident briefings, cognitive behavioural therapy and Eye Movement Desensitisation and Reprogramming.

Conclusions: There is a need for empirical research on effective ways to prevent and reduce these negative effects.

## 3. Key words

Post Traumatic Stress Disorder; Accident, Critical Incident, Workplace, Occupational; trauma prevention;; suicide, prevention, railway.

## 4. Introduction

Major incidents involving a loss of life or injuries are common in the railway industry and employees are likely to experience several critical incidents (CIs) during their career. For example, an American study estimated that a railway crew member will be involved in an average of three fatalities during his career (Napper, 1998). These employees are in need of support and care to help them cope and recover from involvement in a CI. This review focuses upon answering the following question: What is the effectiveness of different interventions in and outside of the workplace, to prevent or reduce the negative effects of critical incidents on railway employees? There are two levels of intervention:

- Workplace incident management and support protocols aiming to reduce the negative effects of CIs
- Therapeutic interventions aiming to reduce trauma symptoms.

The effectiveness of both levels of intervention will be addressed in the review since they are at least partly inter-related.

In order to design and implement effective measures, railway stakeholders must be able to refer to descriptive and evaluative studies of potentially useful practices to determine best practices. We analysed the strength and weaknesses of the literature reviewed, summarized our main conclusions and discussed needs for further research to evaluate and develop effective prevention, intervention and support strategies for railway personnel.

## 5. Method

### 5.1. Research strategy

We first searched the major scientific databases, PubMed, Scopus, PAIS, PsychInfo and the open web for publications in English and French using the following keywords:

PTSD, Stress Disorders, Post-Traumatic, Stress, Psychological, Traumatic, Acute; driver*, engineer*, train, railway*, railtrack, rail*, subway*, metro, public transport, underground, locomotive, fatalit*, trauma*, suicid*, trepass*, person under train. Second, we searched databases from governing bodies in Europe, Australia and North America to identify unpublished reports and documents about railway major incidents and safety and we wrote to the major railways around the world to ask for any reports or publications on support for their personnel.

We identified 16 published documents describing (and sometimes evaluating) interventions to reduce the traumatic effects of a CI. A large part of these studies were descriptive and did not report evaluative research data. We also identified three documents describing recommendations for company based interventions to reduce traumatic reactions after a railway CI.

### 5.2. Literature review strategy

We evaluated the strength of the scientific evidence associated with each intervention strategy using the following criteria: the number of descriptive and evaluative studies, the quality and clarity of the theory of the problem and of the theory of the programme, the level of implementation of the programme, the representivity of the samples, the quality of the effectiveness evaluation protocol, the criteria used to measure the effects of the intervention, and the observed effects. When applicable, we complemented our review of the interventions with results from effectiveness studies with workers in other settings. Our categorisation according to these criteria is presented summarized in Table 1.

*Insert Table 1 here*

### 5.3. Incidents included in the review

In the context of this review, we include studies describing interventions implemented after various types of railway related events including collisions with pedestrians or vehicles, both intentional (suicides) and accidental, major derailments, major close calls when a collision almost occurred, cases of found bodies on the railway and property. We refer to these events as Critical Incidents (CI).

### 5.4. Studies Included

Three documents described railway company protocols that could be implemented to reduce the effects of CIs. These were based on existing best management practices and did not include evaluation of complete protocols.

Sixteen studies described interventions to reduce the effects of a CI. Twelve evaluate their effects (Cothereau, 2004; Foss, 1994; Högberg et al., 2007; Högberg et al., 2008; Limosin et al., 2006; Mehnert et al., 2012; Pagani et al., 2007; Rombom, 2006). and the other four assessed the level of satisfaction with the intervention by employees (Antony, 2010; Briem et al., 2007; Neary-Owens, 2001).

Overall, we therefore included 19 documents in the analyses below.

## 6. Results

As described in the method sectin, two levels of intervention were identified. First, protocols published by governing bodies, research projects and those used by railway companies. These included guidelines for trauma reduction programmes and guidelines for actions to be taken by the company in order to prevent or reduce trauma. Secondly, there were therapeutic and other clinical interventions implemented and evaluated and aiming to work directly with conductors and engineers after their involvement in a CI to reduce their individual existing symptoms.

This section first describes guidelines and then trauma clinical prevention and treatment interventions.

## 6.1. Guidelines and company regulations

General guidelines provided guidance in the development and implementation of company level support and intervention protocols after CIs in the railway industry. The SOVERN project (Abbott et al., 2003) used a Delphi process with the main railway industry stakeholders in the UK, to obtain a consensus of experts on the policies and practices to implement throughout the industry in order to prevent fatalities and manage incidents more efficiently. The technique is applied using case studies in which groups of participants indicate what would be a good procedure to implement. The goal was to evaluate the effectiveness of practices in managing the impact of railway suicides and to making recommendations to improve existing practices. The result of this consultation process was agreement on six statements regarding support to train crews after an incident: 1) Counselling and support should be offered to train drivers: 2) Support by a skilled counsellor should be offered to the train drivers by their occupational health service; 3) The counselling should be in accordance with best practices; 4) Drivers should be given the option to be relieved from duty; 5) If the train driver is allowed to drive the train to the depot, he must be accompanied by someone who could take over if necessary; and 6) To avoid the driver feeling isolated and unsupported, contact between driver and their line manager should be maintained.

Unfortunately these recommendations did not include any specifics on what constituted best practices, the qualifications of a skilled counsellor or how to implement other forms of support. There were wide discrepancies in what stakeholders considered best practices. For instance interviewees in the Delphi process could not agree on the importance of giving drivers appropriate leave from

work (ratings ranging from 14% "not a priority" to 25% "essential" and 46% "very important"). Also, the lack of precision in the statements which were agreed upon reflected the great difficulties the group had to agree on what are best care practices. The lack of empirical data may have been an issue at that time.

The Rail Safety and Standards Board, UK (RSSB) produced the Trauma mitigation schemes in the UK in 2005 (Burrows, 2005), based upon a literature review and current "good practices" by railway companies. These practices have not, to our knowledge, been subjected to formal evaluation. They advocated the idea that CI management should take place in three stages: before incidents occur (by training and policy development), during incidents (by incident management and taking the drivers off the scene) and afterwards (by professional and peer support, follow-up and rehabilitation). This management programme was recommended whatever the nature of the CI (accident, suicide, non fatal or other).

The Australian railways worked together to produce a railway industry trauma management framework (Phelps, 2012) that included best practices principles developed from a consensus from industry stakeholders that was also validated by outside expert opinions. This framework included recommendations concerning the work place culture, recruitment, pre-incident preparation, incident management, post incident follow-up and return to work protocols. The effectiveness of this framework has not yet been evaluated with railway crew members.

So far, we have not been able to identify studies that evaluated these types of protocols as comprehensive programmes, taking account of the effect of their various components and their combination.

The railway industry medical rules play an important role in how people who experience a CI are treated. The Canadian Railway Medical Rules Handbook (Railway Association of Canada, 2010) is a good example of these effects. Railway crew work in safety critical positions (SCP) and their ability to work is evaluated using these SCP

medical rules. The main focus of the handbook is the evaluation of the potential impairment of railway personnel. The rules focus on the psychiatric evaluation of fitness to work and on the possible impact of medication on judgement and attention capacities. It raises the issue of psychiatric diagnosis and its potential impact on crew members. According to the handbook, a person diagnosed with acute stress disorder (ASD) or with PTSD cannot work a SCP. A person who suffers from ASD must be symptom free for one month before returning to work. A person with PTSD has to be symptom free for three months before returning to work. It also dichotomises the nature of trauma reactions. Either the employee is diagnosed as having a psychiatric disorder and cannot work, or he is fit to work and therefore is not encouraged or required to seek support and treatment. These rules can create heavy financial burden for train crews who are forced to remain off work for a minimum of three months if they receive a diagnosis of PTSD. For this reason, workers have said that they often refrain from seeking professional help for fear of being put on leave for a long period of time if they are given a diagnosis of PTSD (Bardon & Mishara, 2014). The problems with the way the impact of diagnoses inhibits help-seeking has been also raised in the US (Weiss & Farrell, 2006) concerning the Federal Employers' Liability Act (FELA).

### 6.2. Interventions and their effects

This section synthesises studies of the components of interventions to prevent or reduce the negative impact of CIs on railway crew. We identified 16 studies and published reports between 1994 and 2013. To complete the literature review, we conducted a survey of 147 railway companies around the world to better understand the nature of existing support practices for crew members confronted with a railway CI. A small sample of 11% companies responded to our survey.

Table 2 summarizes the quality assessment we made of the studies according to the criteria defined in the introduction.

*Insert Table 2 about here*

### 6.2.1. Prevention, on site intervention, follow-up and treatments provided by the employer

#### 6.2.1.1. Prevention (information and training)

There are no empirical investigations of the effectiveness of prevention programmes before CI occur. However, crew members have said that they would like to have information and training sessions on CIs, stress management, incident management as well as support and care (Margiotta, 2000; Neary-Owens, 2001). They felt that they would be more prepared if they have learned in advance what to expect from themselves and from others when incidents occur. Some train crew members also expressed the need to be more informed about the effects of experiencing multiple incidents, how they manifest themselves and what can be done to prevent them (Margiotta, 2000; Mishara & Bardon, 2013c).

Crew members also felt that training should be provided for managers to help them handle traumatic events and evaluate the potential difficulties for their crew (Margiotta, 2000). Such a training programme is in place in France at the SNCF (Teneul, 2009) to educate all middle management on how to better support their train drivers in a situation of intense stress and to educate station managers in handling CIs. However, this programme's effects on post-CI reactions have yet to be evaluated.

Neary-Owens (2001) and Abbott et al. (2003) suggested key elements that preventive training should include: information on railway suicide and fatalities, stress and its

effects (both physical and emotional), understanding emotional reactions, legal regulations and protocols following an incident and available resources for help.
Similar strategies have been implemented and evaluated in other high risk professions with very positive outcomes, for example, the police (Arnetz et al., 2008). Trained police officers experienced less symptoms after a traumatic event than untrained ones. Therefore, these strategies can be classified as promising although they need to be evaluated in the railway context.

6.2.1.2. Interventions immediately after the incident (incident management)

Although most railway companies have technical protocols that describe how to ensure a safe and legal handling at the scene of CIs, there are no formal descriptions of things that first line management can do to reduce the traumatic effect of CIs. However, some recommendations have been made based upon interviews with railway personnel who were involved in fatalities. Margiotta (2000). Bardon and Mishara (2014) found that compassionate handling by managers seemed as a key element to successful recovery after CIs. Workers felt that managers should be in charge of the scene and limit access to the crew by investigators. They also felt that managers should be trained in identifying stress responses so that they could identify and intervene to help crew members (Margiotta, 2000; Mishara & Bardon, 2013c). Bardon and Mishara (2014) found that incident management and the first line managers' behaviour could have a profound effect on the development of post CI consequences. Clumsy or inappropriate management could induce long term negative effects, even in the presence of a positive and caring attitude.
Although there was no empirical evidence that the way the incident was handled at the scene reduced trauma after a fatality, there was a consensus from most people interviewed in different studies (Abbott et al., 2003; Margiotta, 2000) and expert recommendations (Phelps, 2012) that when the manager was caring and

compassionate, and the protocols clear and respected, the event was less traumatic. Because of this consensus, we consider these strategies as promising. They are also cost effective, because they mainly rely on existing company structures and manager training.

#### 6.2.1.3. Demobilisation (relief from duty)

Demobilisation refers to the removal of the employees from the incident scene and their return to a safe place (workplace, home, hospital, Burrows, 2005). In some cases drivers make the decision themselves as to whether they feel fit to continue the trip, and in others cases removal is compulsory. Since they may not be able to correctly assess their own condition at the time, it is a good practice to oblige drivers to leave the train (Burrows, 2005) but there does not seem to be a consensus on this issue among stakeholders (Abbott et al., 2003). The retrospective study of experiences with CIs by Bardon & Mishara (2014) suggested that demobilisation should be made compulsory. In support of this suggestion, we observed that interviewees described their lack of awareness of their own condition after the incident and their inability to be a good judge of their own capacity to work (Mishara & Bardon, 2013b). Also, local managers who may feel pressure to resume traffic may not be the best judge of an employee's fitness to work, especially if a negative assessment would involve more delays and therefore more pressure on these managers. Finally, standardised practices reduce the presence of uncertainty, eliminate the need for discussions and negotiations, and they may help reinstate a sense of control over the situation during and after a work related CI (Burke, 2012; Kinder & Rick, 2012). Therefore, making demobilisation compulsory would limit the risk of inadequate judgement calls, being involved in emotionally charged arguments and the perception by employees of being neglected. Demobilisation is included in most guidelines and railway company protocols (Abbott et al., 2003; Burrows, 2005; Phelps, 2012).

Demobilisation after a CI is an important practice that may be helpful in several areas: reducing the impact of a train fatality on workers, reducing the number of errors made by drivers in shock, possibly enabling people to recover quicker, maintain better working relations and return to work in a better state of mind. It is also one of the most common practices in the railway industry. However, there are no indications that this practice is sufficient on its own to prevent the development of post traumatic reactions or other mid and long term negative effects (Bardon & Mishara, 2014).

#### 6.2.1.4. Time off work immediately after the incident

Our survey of company policies indicated that taking some time off work is the most common option offered to crew members by their employers in the aftermath of a CI. This time off immediately after the incident is different from a long term leave of absence based upon a doctor's recommendation. Time off in the first few days after an incident is provided with pay by the company, usually up to three days. There does not seem to be consensual practices in this area and there is some debate as to whether time off should be mandatory or optional and how much time off should be given after a CI (Abbott et al., 2003; Burrows, 2005). Some studies recommend that there should be more flexibility in the time off drivers can take after a CI (for example, Margiotta, 2000). At the present time, in Canada drivers are allowed to take up to 72 hours off work after a fatality (Mishara & Bardon, 2013b) and for one company the three days off is mandatory with 2 more days optional. Being able to take some time off work to unwind and return to normalcy has been reported by workers to be associated with quicker recovery after a CI (Bardon & Mishara, 2014).

Abbott et al. (2003) recommended that time off should be optional depending upon the manager's assessment and the driver's coping style. This recommendation induces a major issue of evaluation. How does the manager evaluate the driver's state and coping style? Also, managers are under pressure for efficiency and may

communicate this pressure to drivers who can understand that the manager wants them to come back to work quickly.

Compulsory time off seems to be a good practice at both individual and organisational levels since it alleviates pressure on crew members and managers. However, since there are no empirical data on its impact, this practice should be studied and different lengths of time off should be compared in order to determine how long is adequate to obtain the desired effect.

#### 6.2.1.5. Return to work policy

Railways guidelines give some indications on "return to work" policies concerning when to return and the conditions for the return. However, there are no indications that these recommendations are being implemented regularly in company policies and we are not aware of evaluation studies of their effects. Burrows (2005) underscored the need for the return to work to be planned carefully with the manager, driver and mental health support team, in accordance with work regulations. These elements depend a lot on the quality of the organisational climate in the company (Burrows, 2005).When protocols were not clear, pressure to return to work was perceived as being associated with increased post CI difficulties (Bardon & Mishara, 2014).

Briem et al. (2007) recommended that the company health officer systematically should conduct an evaluation for fitness to work before any decision concerning the employee's return is made. Bardon & Mishara (2014) emphasised that crew members should take part in this decision as part of the recovery process from the traumatic event that often resulted in feelings of helplessness and powerlessness. Return to work policies also raise the issue of trust and confidentiality between company officers and employees. From our previous study of the impact of railway CI (Bardon & Mishara, 2014; Mishara & Bardon, 2013b), we found that company medical officers

were sometimes perceived as employers' agents who aimed at returning people to work as soon as possible in order to save costs. Trust, in these cases, was very low.

Phelps (2012) recommended that return to work should be carefully planned, involving the employee and his manager, be collaborative but based on clearly stated expectations for recovery and return. This can include mentoring or progressive return.

These return-to-work processes have not been formally evaluated. Further research is needed before empirically validated recommendations can be made. They are therefore classified as uncertain. However, they could be systematically developed and included in CI management protocols.

#### 6.2.1.6. Follow-up by a company medical officer

Follow-up by a company medical officer has been described in Sweden (Briem et al., 2007; Foss, 1994) and France (Cothereau, 2004). In Sweden, Foss (1994) described the early intervention "Mental Health First Aid" provided by company medical officers starting at the accident site and based on the following principles: avoid any guilt, use common sense, be someone who cares at the accident site, stay with the driver as long as he is alone, conduct a follow-up the next day, smooth the contact with outside health officials, explain what a normal stress reaction is, validate feelings and emotions, protect the driver from media and investigation, give the driver objective answers to questions on the reasons why it happened, offer support to go back to work, give information on drugs and tranquilizers and their adverse effects in case of trauma.

The evaluation by Foss (1994) found that help should be provided within three days after an incident if not on site. Those who received the help of a company medical officer within the recommended timeframe came back to work quicker (82% within 4 days, versus 30% for those who had the help after one week), returned to the same

job (89%, versus 70%), felt better than just after the incident (73% versus 38%) and were less likely to have long term mental problem (50%, versus 88%).

Cothereau (2004) did not describe the actual content of the intervention, but they evaluated the effects of accompanying measures provided by the company medical officers at the SNCF, in France. This study compared an experimental group of 202 drivers who had the accompaniment with a control group of 104 drivers three, 12, 24 and 36 months after incident. The experimental group had fewer psychological problems two years later, more often took time off but for a shorter period of time. However, their ability to work did not differ from the group who did not have the programme. After three years, there were no differences between those who had the programme and those who had not. Cothereau (2004) concluded that the accompaniment by company medical officers helped reduce the recovery period after a traumatic event.

These studies show that support provided by a company appointed professional helper within a few days of the CI is an effective practice to reduce the length of recovery.

#### 6.2.1.7. Peer support

Peer support provided by employees who are trained to offer information and referrals is a frequent help structure provided by employers after a CI directly or through their Employee Assistance Programme (EAP). Peer support has been documented in Sweden (Briem et al., 2007), the United States (Margiotta, 2000; Neary-Owens, 2001) and in Canada (Bardon & Mishara, 2014), is recommended in the United Kingdom guidelines (Burrows, 2005) and is mentioned as a potential option by the Australian guidelines (Phelps, 2012).

According to descriptive and qualitative research, there are some conditions that appear to make the peer support more effective in the railway context. It should be

available on a long term basis after the incident (Burrows, 2005; Margiotta, 2000). Short term intervention is not enough. After the initial shock and burst of concern and support, drivers often find themselves alone with their difficulties, when everyone around them has gone back to their normal activities. Therefore, peers should be involved in long term monitoring and follow-up after the incident, as recommended by the English Rail and Safety Standards Board (RSSB) (Burrows, 2005). In order to be effective, peers should be regularly trained, updated and supervised (Burrows, 2005). The study by Mishara & Bardon (2013b, 2013c) confirms the perception by workers of the important role of peers as "brothers who know". They are seen as having a positive effect in most cases after CIs.

Peer support has not been formally evaluated in the railway context. However, qualitative studies indicate that drivers who could talk to a peer after a CI said that they felt it was beneficial (Neary-Owens, 2001). This can be considered a promising practice although there is a need for more empirical evaluations of the specific components of such programmes (Creamer et al., 2012).

### 6.2.2. Outsourced clinical interventions

A larger body of literature addressed therapeutic interventions with train crew members after a CI that aim at preventing or treating PTSD. Several interventions have been used over the years to help train drivers and other crew members cope with CIs, but only a few have been described in detail in the scientific literature and even fewer have been evaluated for their effects on the development and course of traumatic reactions.

#### 6.2.2.1. Debriefing

Recent research has questioned the validity of debriefing as a tool to reduce the incidence of PTSD and it has been recommended that single session debriefing

focusing on the traumatic incident should not be included in recommended practices (National Institute for Clinical Excellence, 2005). Considering the recent warnings by NICE, we should consider that one session of standardised debriefing may be an unsafe support strategy that should not be used to help relieve stress and trauma symptoms in train drivers.

However, debriefing is becoming a standard procedure in the railway industry to help deal with fatalities and is recommended in guidelines. However, many different practices have been called "debriefing." When considering the impact of such strategies in the railway industry, one has to be aware of the different uses of the word. In the railway industry the word "debriefing" is often used to refer to a session of discussion led by a clinician which takes place in the days after the incident. In these sessions, the incident may be discussed but the emphasis is on the emotional responses to the incident and on education concerning possible reactions and the availability of longer term support.

Incident debriefing has been evaluated with Toronto Transit Commission employees (Antony, 2010) and although people appreciated the intervention, there was no significant positive effect of the intervention on PTSD symptoms and length of absence from work. However, in qualitative studies, drivers who received debriefing appreciate it (Cothereau et al., 2004; Williams, Miller, Watson, & Hunt, 1994). Some debriefings have been conducted in groups composed of the different employees involved in the same incident (Mishara & Bardon, 2013b) and participants generally report that they appreciated the experience. Debriefing may therefore be considered as a promising strategy to reduce the negative consequences of railway CIs, although there is a need for empirical data on its effectiveness in reducing the incidence of PTSD symptoms.

#### 6.2.2.2. Cognitive Behavioural Therapy (CBT)

CBT is a widely used therapy approach with a variety of problems and its effectiveness has been scientifically proven in the treatment of PTSD in many different contexts (Hembree & Foa, 2010). However, there is only one study that analysed the effectiveness of CBT to help subway and bus drivers after a CI (Rombom, 2006). The intervention was applied to 300 drivers diagnosed with PTSD following a work related incident (accident or aggression). The transit personnel were treated in an outsourced clinic and files were reviewed for evaluation of the impact of treatment. Treatment included an extensive evaluation process (to assess the presence of ASD or PTSD), the use of relaxation techniques, self-instructional skills (to equip drivers with psychological skills to cope with future events as well as to cope with the current situation), desensitization training, behavioural assignments, cognitive restructuring (to view the incident and their response in a manner which allows them to adjust, accept and move forward – foster recovery and coping), focus on the social aspect of the worker's response (fear of talking to others and being judged – normalise interaction and reintegrate social network) and rational emotive therapy (RET).

The study by Rombom (2006) found that drivers who participated in the CBT programme dealt better with future incidents and daily stress. The treatments were terminated within a year with the remission rate of PTSD being 37% within 90 days. However, some drivers needed to change their work settings in order to be able to come back to work. The treatment was more effective with drivers who had a death related trauma and less effective with those who had other types of traumas (for example, an aggression).

An Internet based form of CBT, Intherapy, was developed and evaluated with highly traumatised persons (Lange, van de Ven and Schrieken, 2003). Although there are no published data regarding its use with railway employees, it is currently being used with train drivers in the Netherlands with a high level of satisfaction (personal

communication, Kerkhof, A., autumn 2014). Internet based CBT may be a promising strategy with train drivers, because it is available anytime, anywhere for people whose work schedule is often complexe.

CBT has been proven to be effective in a wide range of situations, but more evaluations in the railway industry would be warranted.

#### 6.2.2.3. Eye Movement Desensitization and Reprocessing

Eye Movement Desensitization and Reprocessing (EMDR) is a non-conventional practice (Abbott et al., 2003) which has been evaluated with train drivers. According to the EMDR Institute (2013): " The EMDR treatment comprises 8 steps: (1) understanding the problem and situation, preparing a treatment plan, (2) stabilisation – patients' emotional and coping skills are consolidated, (3 to 6) desensitisation – patients learn to dissociate negative feelings from memories of the traumatic experience and focus on more positive feelings or beliefs, (7) Closure and reinforcement of self-calming skills and (8) evaluation." The most specific component of EMDR therapy consists of carrying out a series of eye movements accompanied or not by bilateral sounds or tactile stimulation while the patient simultaneously focuses on various aspects of the traumatic experience.

EMDR has been implemented and evaluated in Sweden with Stockholm public transport workers using five 90 minutes sessions over 8 weeks (Abbott et al., 2003). Two effectiveness studies have been published. Pagani et al.(2007), with a sample of 15 Swedish train crews who had experienced a PUT or an assault and who had developed PTSD showed that there are changes in the structure and functioning of the brain after PTSD and that these changes were reversed by the EMDR treatment. Högberg et al. (2007; 2008) have conducted an extensive long term follow up of 12 of the above drivers who completed EMDR treatment. They noted a 60% improvement in PTSD diagnosis after the EMDR treatment. They also observed a long term, but

slower improvement of social functioning, anxiety, well-being and impact of event. Drivers went back to work faster than the control group that was composed of drivers who did not have the EMDR treatment during the same period. Also, their improvement was stable over time. EMDR is also used in one Canadian Railway and drivers who experienced it after a CI found it very useful (Mishara & Bardon, 2013c). This is a promising practice, with extensive empirical evaluation on one small sample of railway employees. However, it is important to replicate this study with larger samples and compare this treatment with other interventions.

#### 6.2.2.4. Inpatient rehabilitation programmes

Although inpatient rehabilitation programmes have not been described in detail, it is interesting to note that a four weeks inpatient rehabilitation programme has been evaluated in Germany for train drivers diagnosed with mental health problems after a traumatic event (Mehnert et al., 2012). This multi-faceted therapeutic intervention included education, exercise, physical therapy, relaxation, psychosocial counselling, CBT and group therapy. The evaluation found a significant decrease in post-traumatic stress disorders, anxiety, depression and overall distress six months after the programme. This empirical study suggests that a comprehensive intervention programme that includes several complementary support and therapeutic activities may be quite effective.

#### 6.2.2.5. Conclusion on clinical care after a railway CI

The common characteristic of all these clinical practices is to address individual symptoms after a traumatic event. Except for post incident debriefing that can be systematically implemented for its potential preventive effect before symptoms appear, the other clinical interventions are generally only activated when diagnosable symptoms are present.

7. Critical Analysis of the Studies on Strategies to Reduce the Negative Effects of CI on Railway Employees

The level of scientific validation of interventions to reduce negative effects after a railway CI is uneven. Some have been subjected to methodologically sound evaluation processes, such as EMDR, CBT and follow-ups by a medical officer. Others have been positively assessed in satisfaction studies, such as standardised and empathetic incident management, time off work or peer support. However, recommendations and guidelines (Abbott et al., 2003; Burrows, 2005) also include practices that have not been evaluated in the railway context nor in other related industries, such as providing prior information and training, demobilisation and flexible return to work policies. There are no evaluation studies that assess the combined effects of different, thus making it difficult to develop global work based strategies that are evidence based.

A weakness of many studies is their choice of indicators of effectiveness. For instance, Rombom (2006) used as an outcome to the effectiveness of a CTB intervention "return to work and end of treatment within 12 months of incident". This indicator may not be relevant to evaluate the effectiveness of the intervention, since impact studies find that without any intervention most negative effects recede within a year after the CI (Bardon & Mishara, 2014).

On a positive note, all of the proposed strategies are based upon explicit theoretical models and the mechanisms by which they can help reduce negative effects are well described.

Impact studies of CIs that include a section on the satisfaction with help received and recommendations by employees for improving practices can provide valuable insight into the experience of CIs and current incident management and support practices, their benefits and downfalls. Such studies have revealed the importance of the

management's empathy, strictly applied protocols, demobilisation and peer support (Briem et al., 2007; Bardon & Mishara, 2014).

The "natural course" to recovery may render the evaluation of support and treatment strategies more difficult since this makes it difficult to differentiate the normal course of recovery from the specific effect of interventions. This may also lead stakeholders to believe that it is unnecessary to intervene, since people get better on their own. However, the few studies that have compared the rapidity and extent of recovery of employees receiving specific support to employees not receiving support have found that support speeds recovery (Cothereau, 2004; Farmer et al., 1992).

This review confirms that there is a need to better understand what helps reduce the incidence and nature of traumatic reactions in railway employees after a CI. The lack of empirical evidence on the effectiveness of some interventions limits our understanding of the optimal combination of elements that would be the most efficient in reducing post CI effects.

So far, research has concentrated on the study of the effectiveness of treatment programmes trauma (ex: EMDR and CBT and inpatient treatment with a combination of various approaches) to help those who already developed traumatic reactions. Nothing in current research results indicates that PTSD or other mental health problems have a different structure and course in railway crew than with other workers. Therefore clinical interventions developed elsewhere with other workers are likely to produce similar positive effects with train crews.

However, there is a great need to study prevention strategies to reduce the likelihood that crew members will develop traumatic reactions and to better understand the role of work relations and interactions with management in the development of preventive programmes. Research in this area needs to focus on the specificities of the context in which the traumatic reactions occur and are treated, as with other at risk work environments (e.g. military, first responders).

In order to answer these questions, there is a need to evaluate organisational practices to identify the most effective ways to prepare and support crew and managers and to manage CIs effectively. Organisations, due to economic constraints, are more likely to adopt support and care practices that have proved effective and have already been adapted to their work environment.

## 8. Conclusions

This review has been limited to publications and other documentation sources in English and French. We may have missed some interventions and protocols in railway organisations that have not been made available outside of their company. In several of the areas we explored, there is a dire lack of evaluative research that prevents us from drawing any conclusions and making empirically based recommendations on the potential benefits of some prevention support and care activities and strategies. Further research is needed in order to provide railway industry stakeholders with evidence-based guidelines to help them implement effective and efficient strategies. However, when combining the existing sources of data, including descriptive studies, qualitative analyses, needs assessments and empirical, it is possible to identify several promising practices which include compassionate incident management, time off work and peer support. Although there are several evaluation studies of treatment programmes, we have little empirical data on the preventive impact of employer support programmes. Evaluations of preventive support programmes could help empower railway stakeholders to implement preventative strategies to offer adequate support to those confronted with CIs, and may have the potential to lower costs of psychological injuries and improve work relations.

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Table 1

Quality of the evaluations of interventions to reduce the negative effects of railway critical incidents (CI)

| Level | Description |
|---|---|
| Inadequate | There are effectiveness studies showing adverse effects of the intervention for railway crew members or at least for people confronted with traumatic events in other situations. |
| Uncertain | The strategy has been described and there is a the theory of the problem. There are no data about implementation or effectiveness in the context of railway CIs or other workers exposed to traumatic events, or effectiveness studies have a poor design quality. |
| Promising | The intervention is well described and there is either one study showing positive outcomes to reduce or prevent negative effects of railway CIs or studies that have positive effects with other groups of people exposed to traumatic events. |
| Effective | The intervention is well described and there are several well constructed effectiveness studies that show reduction of negative effects of railway CIs |

Table 2

Assessment of the Validity of Interventions to Prevent or Reduce Post Incident Negative Effects

| | | Studies | Inadequate | Uncertain | Promising | Effective |
|---|---|---|---|---|---|---|
| Provided by the Employer | Information and Training | (Abbott et al., 2003; Margiotta, 2000; Mishara & Bardon, 2013c; Neary-Owens, 2001; Teneul, 2009) | | x | | |
| | Incident Management | (Abbott et al., 2003; Bardon & Mishara, 2014; Margiotta, 2000; Mishara & Bardon, 2013c; Phelps, 2012) | | | x | |
| | Demobilisation | (Abbott et al., 2003; Burrows, 2005; Mishara & Bardon, 2013c; Phelps, 2012) | | x | | |
| | Time off work | (Abbott et al., 2003; Burrows, 2005; Margiotta, 2000; Mishara & Bardon, 2013b) | | | x | |
| | Return to work policy | (Bardon & Mishara, 2014; Briem et al., 2007; Burrows, 2005; Phelps, 2012) | | x | | |

Table 2

Assessment of the Validity of Interventions to Prevent or Reduce Post Incident Negative Effects

| | | Studies | Inadequate | Uncertain | Promising | Effective |
|---|---|---|---|---|---|---|
| | Follow-up by a company medical officer | (Briem et al., 2007; Cothereau, 2004; Foss, 1994) | | | | x |
| | Peer support | (Briem et al., 2007; Burrows, 2005; Margiotta, 2000; Mishara & Bardon, 2013b, 2013c; Neary-Owens, 2001; Phelps, 2012) | | | x | |
| Outsourced clinical Interventions | Debriefing | (Antony, 2010; Cothereau, 2004; Mishara & Bardon, 2013b; Williams et al., 1994) | x | | | |
| | Cognitive Behavioural Therapy | (Rombom, 2006) | | | | x |
| | Eye Movement Desensitization | (Högberg et al., 2007; Högberg et al., 2008; Pagani et al., 2007) | | | x | |

Table 2

Assessment of the Validity of Interventions to Prevent or Reduce Post Incident Negative Effects

| | | Studies | Inadequate | Uncertain | Promising | Effective |
|---|---|---|---|---|---|---|
| | and Reprocessing | | | | | |
| | Inpatient rehabilitation programmes | (Mehnert et al., 2012) | | | | x |

# CHAPITRE V

# ARTICLE QUATRE

# DEVELOPMENT OF A COMPREHENSIVE EVIDENCE-BASED PROGRAMME TO PREVENT AND REDUCE THE NEGATIVE EFFECTS OF RAILWAY CRITICAL INCIDENTS ON RAILWAY EMPLOYEES

Cet article a été soumis à la revue Archives of Occupational and Environmental Health

## 1. Résumé

Ce chapitre (article trois de la thèse) propose une stratégie de prévention des réactions traumatiques chez les conducteurs et ingénieurs de locomotive, de soutien et de prise en charge après un incident critique sur les voies ferrées, basé sur les meilleures connaissances.

Afin d'enrichir les données issues de la littérature et synthétisées dans le chapitre précédent, nous avons effectué une analyse descriptive du soutien et des services reçus par les ingénieurs et conducteurs de locomotive interviewés dans le cadre de l'article un de l'étude. Sur l'ensemble de 122 incidents décrits, nous avons analysé ceux s'étant produit depuis que des protocoles de soutien et de gestion d'incident sont en place dans les entreprises concernées (N= 71). Nous avons analysé le type d'intervention en place et le niveau de satisfaction des personnes interrogées quant à l'aide reçue. Ce niveau de satisfaction varie en fonction du comportement du gestionnaire local, des officiers de la compagnie et de la police, de la rigueur d'application des protocoles établis, la présence d'attentes déçues de soutien et de soins, la perception de la compétence des cliniciens rencontrés et le niveau de confiance envers l'employeur.

En nous basant à la fois sur les résultats de cette analyse descriptive, sur les recommandations de la littérature et sur des discussions avec des acteurs du réseau ferroviaire canadien, nous avons modélisé un protocole complet, applicable dans le milieu de travail, de prévention des réactions traumatiques, de soutien aux employés et d'offre de soins appropriés afin de réduire l'incidence et l'ampleur des effets négatifs des incidents graves sur les employés. Ce protocole comprend des actions préventives à mettre en place avant que les incidents ne se produisent, des éléments de réponse immédiate (sur les lieux de l'incident), des interventions à faire dans les jours suivants, du soutien à plus long terme (fournis par l'employeur et des ressources externes) et un processus de décision du retour au travail.

## 2. Abstract

This article presents a strategy to prevent, support and care for railway personnel who experienced critical incidents on the job, usually fatalities by accident or suicide. First, we summarized the results from retrospective interviews of the experience of 40 train engineers and conductors involved in 71 incidents. Employees' satisfaction with the help received after the incident varies according to the behaviour of the local manager, company officers and police, the level of compliance with existing company protocols that have been established to help them, the presence of unmet expectations for support and care, the perceived competency of clinicians they consulted and the level of trust toward their employers. On the basis of the interview analysis, a critical review of existing railway practices and discussions with railway stakeholders, a model protocol was developed for a comprehensive workplace prevention, support and care protocol to reduce the negative impact of railway critical incidents on employees. This protocol included preventive actions before traumatic events occur, immediate responses at the site of incident, interventions within the first few days after the incident and longer term support and interventions provided by the company and by outsourced experts.

## 3. Keywords

Railway, fatalities, train, driver, workplace, trauma, prevention, intervention, PTSD

## 4. Introduction

Railway fatalities are common occurrences in the work life of train engineers and conductors. For example, in Canada, there is an average of 98 fatalities per year on railway tracks (Mishara & Bardon, 2013). There are usually two crew member on board the engine. Thus, in Canada there are at least 196 railway employees potentially traumatised by a fatality each year, which represent about 2.2% of the workforce (Total estimated number of engineers and conductors: 9000 according to the union). Therefore, over a 30 year career, crew members have a 65% chance of being involved in a fatality.

Several studies have documented the effects on train crews of involvement in critical incidents (CIs). The effects included diagnosable mental health problems, notably Post-Traumatic Stress Disorder (PTSD) and Acute Stress Disorder (ASD), and non-diagnosable but nevertheless intrusive problems, such as hyper-vigilance, generalised increased anxiety, sleep disturbances and alcohol abuse (Abbott et al., 2003; Austin & Drummond, 1986; Bardon & Mishara, 2014a; Briem et al., 2007; Cothereau et al., 2004; Farmer et al., 1992; Karlehagen et al., 1993; Limosin et al., 2006; Malt et al., 1993; Margiotta, 2000; Meier et al., 1998; Napper, 1998; Theorell et al., 1992; Tranah et al., 1995; Vatshelle & Moen, 1997; Yum et al., 2006).

Major factors that increased the negative effects of railway fatalities on crew members have been identified as: the accumulation of incidents, seeing the victim prior to impact or afterwards, identifying the helplessness of the victim, the inability to make sense of the event, working on the same route again, strong masculine stereotypes, unrelated stressful personal life events, experiencing non-fatal and close call incidents and difficult relations with the employer (Bardon & Mishara, 2014a). Information that emphasizes the responsibility of the victim may reduce the sense that it is the driver's fault. Crew members have expressed that prior knowledge of

what to expect and good quality protocols in place to help them was beneficial (Bardon & Mishara, 2014a).

In order to reduce the negative effects of involvement in a fatality and other railway Critical Incidents (CI), several prevention, support, care and treatment strategies have been developed, and sometimes evaluated.

## 4.1. Prevention strategies

There has been little research on prevention activities before a CI occurs, despite the fact that this was often mentioned as a promising approach (Abbott et al., 2003; Bardon & Mishara, 2014c; Burrows, 2005; Margiotta, 2000). Trainings to crew members could include information on stress and its effects, typical emotional reactions and ways to cope with them, the cumulative impact of experiencing multiple incidents, legal issues, return to work policies and existing protocols for incident management and help (Margiotta, 2000; Neary-Owens, 2001). Training could also be provided to managers (Teneul, 2009) to help them support crew members and manage incidents more effectively.

### 4.1.1. Incident management protocols

Many railway companies have Critical Incident Response Programs (CIRP) and these are prescribed by railway safety boards (Burrows, 2005) and policy development committees (Abbott et al., 2003). CIRP can potentially include procedures and recommendations on how local managers should react, procedures for demobilisation after the incident and time off work for recovery, interventions by company officials, referrals to sources of help and peer support. Apart from often mandating an automatic period off work immediately following the incident, CIRP rarely include other specific actions to be taken or indication of best practices. There

are very little empirical data to support the effectiveness of the various components of CIRP to reduce the negative impact of railway fatalities on crew members (Bardon & Mishara, 2014c).

#### *4.1.1.1. First line management behaviors*

Studies on the impact of railway CIs showed that compassion and empathy from the local manager played a key role in the recovery process (Abbott et al., 2003; Bardon & Mishara, 2014a; Margiotta, 2000) as compassionate management reduced the time for recovery after a CI (Bardon & Mishara, 2014c; Margiotta, 2000). Experts recommended clear and a well-established CIRP to reduce traumatic reactions (Phelps, 2012).

#### *4.1.1.2. Demobilisation or relief from duty*

Demobilisation refers to the removal of the crew member from the incident site and his return to a safe place (Burrows, 2005). This is the most frequent care practice in the railway industry. Demobilisation can be optional, although, based on analysis of the experience of crew members, experts recommend that it be compulsory (Bardon & Mishara, 2014c; Burrows, 2005).

### 4.1.2. Time off work

Taking time off work after a fatality is one of the most common practices in the railway industry (Abbott et al., 2003; Burrows, 2005). It refers to the few days that a crew member can take, with or without pay, to help him cope with the emotional aftermath of a CI. Depending on employers, this time off work can last from 24 hours to up to five days. Although there was no empirical data to support it, time off work was generally perceived as very useful (Bardon & Mishara, 2014c; Margiotta, 2000).

#### 4.1.3. Return to work policies

There are no empirically based standards for what can be done to facilitate the evaluation of readiness to work and the return to work of a railway employee after a CI. Guidelines (Burrows, 2005) recommended that return to work should be planned in collaboration with the manager, the employee and the mental health support team. Others (Briem et al., 2007) emphasized the need for a formal fitness to work evaluation before the employee could return to work.

#### 4.1.4. Peer support

Peer support programs are common in the railway industry (Bardon & Mishara, 2014c; Briem et al., 2007; Burrows, 2005; Margiotta, 2000;). A peer provides emotional support and information on traumatic reactions, options for follow-up and care, time off work and return to work policies.

Peer support programs have not been evaluated empirically. However, qualitative studies suggested that such programs, when offered rapidly after the CI by trained peers, helped reduce the negative effects of CI (Briem et al., 2007; Burrows, 2005; Margiotta, 2000). Other qualitative studies have shown that employees who could talk to a peer after a critical incident found it useful (Neary-Owens, 2001).

### 4.2. Clinical interventions

#### 4.2.1. Post incident clinical debriefing

Clinical debriefing is becoming a standard practice in the railway industry to help employees cope after a CI (Abbott et al., 2003; Bardon & Mishara, 2014c; Cothereau, 2004). Debriefing is performed by trained clinicians within a few days after the CI.

Although this type of short term intervention has not been empirically evaluated in the railway context, crew members reported benefits (Cothereau, 2004; Williams et al., 1994).

### 4.2.2. Cognitive Behavioral therapy (CBT)

CBT is a therapeutic approach widely used to treat various difficulties. Its effectiveness has been demonstrated with a variety of problems such as mood and anxiety disorders, including PTSD (Kahn & Juster, 2002). There is only one empirical study in a group of transportation workers, a study of the effectiveness of CBT to reduce the traumatic reaction of bus and subway drivers (Rombom, 2006). Drivers participating in the CBT program dealt better with subsequent incidents and daily stressors and did not experience long term effects of the traumatic event (after 12 months).

### 4.2.3. Eye Movement Desensitization and Reprocessing

Eye Movement Desensitization and Reprocessing (EMDR) is a treatment practice (Abbott et al., 2003) that has been evaluated with train drivers. EMDR consists of an information processing therapy in eight steps to address the experiential contributors of a wide range of pathologies (EMDR Institute, 2013) in which recollections of traumatic events are dissociated from their emotional impact by using rhythmic eye movements and tapping. Three effectiveness studies have been published (Högberg et al., 2007; Högberg et al., 2008; Pagani et al., 2007) based on short and long term (18 months) follow-ups of Swedish train drivers. They observed an improvement in PTSD symptoms, social functioning, anxiety and impact of the event.

## 5. Objectives of the Project

Considering the current state of scientific knowledge, this article has three objectives, to:

- Describe support and care practices experienced by Canadian railway train drivers
- Assess the level of satisfaction of workers with these practices
- Propose an integrated CI management and support programme based upon an analysis of protective and risk factors for traumatic reactions in the railway workplace, recommendations for best prctices and the experience of Canadian railway employees

## 6. Existing support and Care Practices in Canada and Satisfaction of Railway Crew Members

This section describes a study of the experience of support by railway crew members in Canada. An analysis of the impact of critical incidents on this sample has been reported elsewhere (Bardon & Mishara, 2014a). This current paper reports on the workers' use of and perception of existing support and care practices and their opinions about how to improve upon them.

### 6.1. Method

#### 6.1.1. Participants

Forty Canadian railway engineers and conductors were interviewed about the effects of the CI they experienced during their careers and the support, care and treatment they received to help them cope with those events. They were informed about the project via the Railway Association of Canada website and their union web site, as

well as by their union representatives. Employees who had been involved in CIs and wanted to know more about the study were referred to the research team who contacted them and explained the project. Overall, 53.6% of referred employees took part in the project. All participants gave their informed consent before being interviewed. They described, in sufficient detail to allow analysis, 122 critical incidents (for detailed description of the recruitment, sample and included incidents, see Bardon & Mishara (2014a). Of these 122 CIs, some kind of support was offered to crew members by their employers in 71 instances (58.2%). These incidents all occurred in recent years (since the 1990s) when CIRPs were gradually implemented throughout the industry. Therefore, the present analysis was performed on the 71 incidents for which interviewees said there was some company support available, regardless of the date of incident.

### 6.1.2. Procedure

Interviews were semi-structured and retrospective. A content analysis was performed using a thematic approach (Paillé & Mucchielli, 2012) to identify support strategies and general perceptions of crew members. The components of varied support and care received were classified as practices implemented on site at the time of the incident, company actions in the following days, outsourced therapeutic help afterwards and privately sought help and coded accordingly in a databse. A series of Chi Square analyses were performed to determine the association between the use of different services and the level of satisfaction. Satisfaction was assessed by the perception of the quality of interaction with police, management and company officials, the perceived helpfulness of the intervention and the perception of having enough time off and adequate help.

In order to verify the reliability of the data coding, two persons independently coded all 48 variables in a subsample of 46 cases, which resulted in a mean Kappa of .77. According to the classification by Landis and Koch (1977), substantial agreement (kappa >.600) was achieved for 17 variables (35%), almost perfect agreement (kappa >.800) was achieved for 23 variables (48%) and the remaining eight variables (17%) achieved moderate agreement (kappa >.400).

## 6.2. Results

### 6.2.1. On site interventions and incident management

Incident management included actions carried out by emergency services, the local manager and company representatives in the aftermaths of the CI. Of the 71 incidents included in this analysis, we had information about the incident management for 68 cases (95.4%). The quality of interactions with others immediately after the incident was evaluated from descriptions by employees and rated as negative, neutral or positive (depending on their perception of its effect on their recovery processes). Interactions with police was perceived as generally positive in 73.7% of incidents, with police having a professional attitude, making reasonable requests and in some cases being caring and empathic. Crew members said that, nowadays, in most cases the police behave well with them, rarely questioning their professional competence or asking for help to deal with the victim. Interaction with local managers at the scene of the incident and in the following days was categorised as positive in 57.4% of cases, where crew members felt their supervisor took appropriate care of the situation and of them (by taking control of the incident scene, protecting them from undue questioning and relieving the crew in a timely manner). In the remaining 42.6% of CIs, managers were perceived as abusive, suggesting that crew members may be

responsible for the incident, uncaring about their feelings and condition, or exerting pressure for a return to normal work activities at the site of the incident.

### 6.2.2. Leaving the site and post-incident employer help

Most crew members were taken away from the scene (83.1%). The average delay before leaving the site was estimated to be 161 minutes (2h and 41min.), which was perceived as being too long by interviewees. After their return to their home terminal, they were met by a peer in 27.3% of cases. Most people took time off work (98.2%), up to three days for 52.7% and more than three days for the rest (average 56 days). Those who took more than three days off work had to make a claim with the Workers Compensation Board (WCB) of their province. Their perception of the experience with WCB officers was positive and helpful. However, 22.5% of crew members wished they could have had more time off work after the incident.

Interaction with company officials was perceived as positive after 27.5% of CIs, with claims department personnel and management being seen as supportive during the time off work and during the course of treatment. The remaining 72.5% felt their employer did not support them through their contacts with the workers compensation board (WCB), tried to pressure them to come back to work too soon, tried to prevent them from coming back when they felt ready, were untrustworthy or tried to blame them for what happened.

Railway companies generally provided the support of a peers program. Usually, peers met the returning crew members at their home terminal. These meetings were mentioned after 27.3% of the incidents, with perceived positive effects in two third of instances. This type of support was present in all major Canadian railways and was usually operated by the Employee and Family Assistance Programme (EFAP). The

peers provided on the spot support, encouraged the crew member to use available services and offered a follow-up.

Finally, it is important to note that a substantial number of crew members felt pressured to return to work before they were ready (41.3%), either experiencing financial pressure or pressure from their employers. Return to work processes were rarely formalised into standard procedures.

### 6.2.3. Outsourced clinical support

Clinical support was provided by Employees and Family Assistance Programs (EFAP). In 49.3% of incidents, interviewees said they used the services provided by the EFAP. Provided help was referrals or proactive contacts by a counsellor. A majority of workers who had contact with an EFAP counsellor found the experience helpful (65%). Those who reported negative experiences with the counsellor cited a lack of professionalism or expertise in the helper and a lack of trust in their confidentiality, largely because of their suspected association with their employer. On average, people had 2.5 (range from 1 to 3) sessions of counselling. These counselling sessions are apart from debriefing sessions. A number of crew members (n=13) said they also took part in a standardised debriefing session offered by a specialist, individually or in group and found the experience helpful to understand what happened and their reactions.

### 6.2.4. Private help seeking

Some crew members preferred seeking help by themselves. Eighteen (25.3%) saw their own doctor to obtain a follow-up or a prescription for time off work and eight consulted a private mental health professional. People said that they chose private

support because of lack of trust in their employer or because of familiarity and positive past experiences with their own resources.

6.2.5. The association between the impact of critical incidents and help received Overall, of those who provided information on the subject, 56.8% said they received enough help to overcome the traumatic consequences of the CI. There was not sufficient data to proceed with complex statistical analysis (N=71). Chi Squares tests were performed to identify possible associations between support practices and measures of the effects of CIs (for detailed description of effects measures, see Bardon & Mishara, 2014a). Crew members who used private resources, such as consulting their doctor or meeting with a private counsellor, were more likely to have experienced an intense physiological reaction at the time of incident ($\chi^2 = 4.987$, $p = .039$, $df = 1$), intense general fatigue after the incident ($\chi^2 = 4.968$, $p = .040$, $df = 1$) or had received a diagnosis of a traumatic reaction such as PTSD ($\chi^2 = 12.932$, $p = .001$, $df = 1$). Crew members who used the services provided by the EFAP were more likely to have experienced intense helplessness at the time of the incident ($\chi^2 = 6.728$, $p = .013$, $df = 1$) and symptoms of agitation ($F = 6.811$, $p = .011$, $Eta^2 = .090$, $df = 69$). Crew members who took more than the standard three days off work were more likely to have experienced emotional dissociation at the time of incident ($\chi^2 = 6.970$, $p = .012$, $df = 1$), to have received a PTSD or ADS diagnosis ($\chi^2 = 16.304$, $p = .001$, $df = 1$) or intrusive stress related symptoms ($\chi^2 = 4.423$, $p = .044$, $df = 1$). People who wished they had more time off work to recover were more likely to have experienced emotional dissociation ($\chi^2 = 6.240$, $p = .022$, $df = 1$) and symptoms associated with loss of concentration and guilt ($F = 5.105$, $p = .027$, $Eta^2 = .069$, $df = 69$). Those who used Workers Compensation Board services were more likely to have been diagnosed with

PTSD ($\chi^2$ = 21.718, $p$ = .001, $df$ = 1) or have intrusive stress related symptoms ($\chi^2$ = 10.566, $p$ = .001, $df$ = 1).

7. Recommendations by employees to improve incident management and support practices

During the interviews, crew members were asked to identify areas of possible improvement in support practices. Recommendations addressed the different phases of incident management, but mainly concerned the way employers could help in the situation. They often concerned the lack of clarity of procedures that could induce ambiguities and unwelcome arguments in a time of acute crisis. Table 1 summarises these recommendations.

*Insert Table 1 here*

8. Proposal for an Integrated Prevention, Intervention and Support Strategy

This section presents an integrated model for the prevention, intervention and support of railway personnel involved in a CI. It is comprehensive since it includes in the same protocol prevention activities, interventions at the time of the incident and immediately after, as well as a variety of follow-ups activities. It integrates traditional critical incident management protocols (CIRP) that are commonly implemented throughout the railway industry with a wide range of potential actions to reduce the negative impact of a CI. It integrates research that has validated different program components, studies of workers' satisfaction with current strategies with recommendations from workers and industry stakeholders. It is also consistent with the recommendations made by the Rail Safety standard Board published in Great Britain (Burrows, 2005), the SOVERN project (Abbott et al., 2003), our review of

existing support practices (Bardon & Mishara, 2014c), the results of our interview study with railway workers involved in CIs (Bardon & Mishara, 2014a) and the current practices of the Canadian railway industry (previous section). It also takes into account the impact of various CI management practices that have been identified as helpful or negative in the development of post-CI negative effects, such as the presence of a manager on site, being treated as a victim of the CI, the quality of the interactions with local managers and the employer and the presence of conflicts (Bardon & Mishara, 2014a). It takes into account the constraints of the railway industry in terms of finances, existing resources, workers compensation board regulations and the Canadian Railway Medical Rules Handbook that defines work relate consequences of medical conditions in the railway industry (Railway Association of Canada, 2010).

In addition to these varied sources, the protocol is based on the following principles:

a. Risk and protective factors should be developed long before CIs occur
b. Critical incidents create situations of intense feelings of helplessness on the part of crew members. Helplessness is in turn strongly associated with the development of traumatic reactions (Cyrulnik, 2013). Having the crew member be involved in decision making post incident, including in decisions concerning the return to work and length of absence, can be a very positive experience, helping the crew member regain some control over the situation and his own well-being.
c. Work relations play a key role in recovery after a work related CI, at two distinct levels. First, the context in which the CI occurred can be viewed as the cause of the trauma to the person. People may feel their workplace is responsible for their suffering. This feeling can be exacerbated by poor work relations and feelings of abandonment after the event (Bardon & Mishara, 2014a). Secondly, as the primary care provider, the workplace can "make

things better" and help overcome the trauma. This role comes with several benefits. Employers who implement effective CIRP help reduce symptoms for their employees, reduce health care costs and absenteeism and improve work relations (Attridge & VandePol, 2010). Involvement of the employer in the support and care process is a key component to recovery at the individual and collective levels.

The first draft of this proposal, based on the above considerations, was presented at several railway industry meetings to solicit recommendations and discussions with stakeholders, before the final version presented here was completed.

Table 2 synthesises the different phases of a comprehensive strategy to prevent and reduce the negative impact of railway CIs on crew members.

*Insert table 2 here*

## 9. Discussion

Intervention and support practices have evolved greatly over the past few decades throughout the railway industry (Abbott et al., 2003) with an increasing awareness of the potentially traumatic effects of CIs. More emphasis is currently placed on the way employers can help mitigate these effects, through management practices, such as demobilization, provision of time off work and availability of help from Employee Assistance Program and peer support programs.

Our results confirm the relevance of these practices but also emphasise the role played by incident management protocols and post incident management practices in the recovery process after a CI (work accident claims management and return to work policies and practices). The attitude of the manager, the ease with which one navigates the claims processes, the clarity of various support and intervention options

and their consequences seem to also be very important in the recovery process. We also identify the need for prevention strategies integrated throughout company practices.

More efforts still have to be made to provide adequate support and intervention after a RFICC, since almost one in two crew members felt they did not receive enough help. We hypothesise that this feeling of insufficient support may be a result of the medical approach of the railway medical rule handbook (Railway Association of Canada, 2010). As was briefly described in the introduction (Chapter 1), the rules define the criteria for fitness to work according to the presence or absence of a mental health problem and related symptoms. The application of the rule to individual situations after a CI tends to dichotomise the perception of the effects of CIs into people suffering from PTSD or Depression who are obligated to take time off work and be treated, and those who are fit to work. Therefore, those who are determined to be fit to work are not perceived as requiring interventions or help. This perception may discourage people from seeking the help they need to overcome non-diagnosed but intrusive negative effects of CIs that are not sufficiently intense to warrant a diagnosis of PTSD or Depression (Bardon & Mishara, 2014a).

Our results indicate that people seek different types of help, such as their own medical doctor, a private therapist or the EFAP clinician. These professionals may not know about the specificities of the railway context and may not be trained in the intervention approaches that are recognised as effective in this context, such as Cognitive Behavioural Therapy or Eye Movement Desensitization and Reprocessing. This may also play a part in the level of crew satisfaction with the help they receive.

Help seeking may not be easy for railway workers who may adhere to strong masculine stereotypes. Therefore any intervention program needs to include proactive offers of help, support, care and treatment at several key moments after

the CI. This proactive offer of help should be imbedded in company protocols and the employer may be the best partner to implement it.

There are a variety of potential strategies to reduce the occurrence of traumatic reactions such as training crew and managers, designing and rigorously implementing proper critical incident management protocols, identifying and training health professionals and developing peer support programmes. There are also several interventions to reduce and treat symptoms, such as post incident briefing (individual or in groups), CBT and EMDR, that have been subjected to empirical evaluation studies, with encouraging results and are being offered to railway workers in several companies. However, preventive strategies have yet to be empirically evaluated and implemented widely in the railway network. Further research is needed to develop proper evidence based intervention programmes in which railway companies could invest with a satisfactory level of certainty as to their effectiveness.

In order to improve on existing practices, a few key issues have to be taken into consideration. Railway CI management involves several different actors (local police, emergency services, members of the public, local authorities, local managers, company officials, insurance claim department, railway safety authorities, judiciary system, etc). Because of the low incidence of railway CIs in Canada spread across over more than 40,000 km of track, incidents are likely to involve non-railway personnel who are confronted with their first railway CI at the time of their intervention. It is therefore impossible to train all those involved and expect consistent interventions throughout the railway network at all times. Therefore, the development of incident management protocols should take this lack of local knowledge into consideration and railway companies could convey these concerns to people involved locally when incidents occur.

It is recommended that companies become involved in prevention, but leave clinical intervention to trained professionals. When the provider of treatment remains outside of the company's structure and perceived influence, trust is easier to build.

The type of protocol we propose underscores the importance of evaluation and flexibility. Since post incident negative effects can evolve over time, it is crucial to assess the employee's needs at different points in time and adapt the interventions accordingly.

The protocol we propose includes training for crew and managers, open communication at all levels of post incident management, evaluation of the crew member's condition at all steps of the process and adapting support to this evaluation. We propose a comprehensive program that addresses each phase in the process based upon the premise that no one single intervention will be sufficient and a combination of actions carried out at different levels is essential. A final step in the development of this protocol will be the evaluation of the effectiveness of its various components to reduce the incidence and scope of negative effects of CIs.

## 10. Conclusion

Although the protocol is based upon a complete review of prior studies and existing practices, the new study we present is limited by its use of retrospective data. It was difficult for interviewees to remember all the interventions that took place concerning the various incidents in which they were involved. However, mixed methods of data treatment and analysis (Morse, 2010), including qualitative analysis and systematic coding of variables across all cases allowed for a more detailed understanding of the situations described by the interviewees. Furthermore, comparison of the retrospective data with research results and company experiences and protocols allowed for some confirmation of the results by collaboration from multiple sources.

This protocol will need to be empirically validated. An evaluation study is currently being conducted with the collaboration of a major railway company and the collaboration of the railway union, in Canada.

Based upon our analysis of interviews with railway crew members who were involved in railway CIs and assessed the helpfulness of existing programmes and services and an in-depth review of published best practices and research results, we present an innovative model programme which includes several factors rarely addressed in previous proposals, which have mostly limited their concerns to the prevention and treatment of severe reactions, such as PTSD. We specifically focus on how employers may help prevent and minimize the negative impact, based upon research indicating that work related factors play an important role in the development and continuation of negative effects of a CI. This approach contrasts with studies that mainly consider and evaluate individual factors associated with traumatic reactions after a CI (Abbott et al., 2003; Briem et al., 2007; Karlehagen et al., 1993; Limosin et al., 2006) and therefore focus only on interventions with individual factors (adaptation, coping mechanisms and therapy). However, there is support of our approach from some studies of the benefits of accompaniment (Cothereau, 2004) and of the negative consequences of incident reporting protocols focusing on blame and establishing responsibilities (Margiotta, 2000).

It is important that the implementation and effects of these practices be evaluated in order to ascertain their impact in reducing the negative effects of CIs on railway workers. The interview study we used to help develop our recommendation was retrospective and was not aimed at evaluating the effectiveness of actual support processes throughout the railway industry. However, when results from content analysis or our interviews are combined with the existing literature on support provided to train crews after a CI, the recommendations from both sources concur to

provide a clear overview of actions that can be taken to reduce more effectively the impact of being involved in fatalities and other critical incidents.

The programme we propose may be useful to adapt to other workplaces where critical incidents may occur in the context of daily routines, where employees are not emergency service specialists but may have to intervene in a situation of crisis or danger.

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Table 1

*Recommendations by Employees for Better Support and Care After a Critical Incident*

| Area of Intervention | Nature of Intervention | Strategies to Improve Access and Use | Conditions for Effectiveness and Expected Effects |
|---|---|---|---|
| On site Intervention | Systematic relief of duty | Relief within 2 hours after incident<br>Having one person in charge of incident management and to control access to crew by others (emergency services, police, coroner) | No debate nor argument about asking crew to move the train lessens pressure<br>Constant contact during the time spent on site (not being left alone)<br>Positive and caring attitude on site from managers<br>Extend demobilisation to non-fatal collisions |
| Back at the Terminal and Follow-Up | Clearly described procedures, specifying options and financial impact<br>Offer a ride home | Strict observance of protocol<br>Involvement of management and company officers in caring follow-ups | No discussion of the length of time-off at this early stage<br>Discussion of all possible options of support and care |

Table 1

*Recommendations by Employees for Better Support and Care After a Critical Incident*

| Area of Intervention | Nature of Intervention | Strategies to Improve Access and Use | Conditions for Effectiveness and Expected Effects |
|---|---|---|---|
| | No pressure to return to work | Clearly separate psychological from technical briefings by managers<br>Clear description of the consequences of various time off options<br>Offer possibility for delayed time-off and flexibility in the duration of the time-off | No decision made within 24h<br>Need to feel the employer cares<br>Assessment of fitness to work conducted by an independent assessor<br>Support from union |
| Return to Work | Flexibility in options for return (light duty, progressive) | Have clearly written protocols and options with their consequences specified | Re-evaluation of fitness to work before return to normal duties<br>Managers acknowledge the traumatic nature of the event and helplessness of crew |

Table 1

*Recommendations by Employees for Better Support and Care After a Critical Incident*

| Area of Intervention | Nature of Intervention | Strategies to Improve Access and Use | Conditions for Effectiveness and Expected Effects |
|---|---|---|---|
| | | | members to have prevented it |
| Employee Assistance Programme (EAP) | Information offered at the terminal<br>Proactive contact made by the EFAP counsellor the next day | The role of peers and counsellors explained and distinguished | Peers emotionally detached from experience of crew member<br>Regularity in the support provided by different counsellors within an EAP service to warranty the overall quality of treatment offered |
| Debriefing | Independent health professional<br>Flexibility in the number of sessions with the | Systematic offer for a briefing within 48 hours of incident<br>Proactive contact made by the clinician<br>Psychological briefing conducted separately | Clinicians knowledgeable of the industry and of railway incidents<br>Expectations for contact and support met rigorously |

Table 1

*Recommendations by Employees for Better Support and Care After a Critical Incident*

| Area of Intervention | Nature of Intervention | Strategies to Improve Access and Use | Conditions for Effectiveness and Expected Effects |
|---|---|---|---|
| | same professional | from technical briefing by counsellors | Trust the independence of the clinician |
| Information and Training | Information on traumatic events and trauma reactions<br>Information on company protocols, EFAP and WCB practices<br>Pros and cons of all available options for support and care explained clearly | Information provided during initial training and during requalification | |

Table 2

*Model Program to Prevent and Reduce the Impact of Railway fatalities, Injuries and Close Calls on Railway Workers*

| Timeline of Events | Reactions and Effects of Events | Factors Associated With the Situation | | Work Related Factors and Incident Management Factors | | Strategies to reduce the impact |
|---|---|---|---|---|---|---|
| | | Risk Factors[3] | Protective Factors[4] | Risk Factors [3] | Protective Factors [4] | |
| Prior to Incident | | Personal life events and stressors<br>Previous incidents (fatalities and close calls)<br>Seniority | Strong personal support network | High level of stress on the job | Prior training and information<br>Good work relations | Information and training (train crews, supervisors) on what happens during and after incidents (possible reactions, cumulative effects, protocols and offered support, identification of support network)<br>Identification and training of outsourced specialised resources for future referrals |

[3] [3] Risk factor for increased negative impact of railway fatality, injuries and close call (RFICC) or for maintaining negative impact over time

[4] [4] Protective factors for reducing impact of RFICC

Table 2

*Model Program to Prevent and Reduce the Impact of Railway fatalities, Injuries and Close Calls on Railway Workers*

| Timeline of Events | Reactions and Effects of Events | Factors Associated With the Situation | | Work Related Factors and Incident Management Factors | | Strategies to reduce the impact |
|---|---|---|---|---|---|---|
| | | Risk Factors[3] | Protective Factors[4] | Risk Factors [3] | Protective Factors [4] | |
| | | Masculine stereotypes | | | | Design and implementation of strict and detailed incident management protocols that take into account the reduction of risk factors and the promotion of protective factors, the time off and all options pertaining with consequences and benefits (pay, missed trips, return protocol)<br>Implementation of a comprehensive peer support program (including regular training up dates and follow-ups and a careful recruitment of peers) if possible supported |

Table 2

*Model Program to Prevent and Reduce the Impact of Railway fatalities, Injuries and Close Calls on Railway Workers*

| Timeline of Events | Reactions and Effects of Events | Factors Associated With the Situation | | Work Related Factors and Incident Management Factors | | Strategies to reduce the impact |
|---|---|---|---|---|---|---|
| | | Risk Factors[3] | Protective Factors[4] | Risk Factors [3] | Protective Factors [4] | |
| | | | | | | as well by the union (for strong involvement of the union) |
| Short Term:<br><br>At the Time of Incident | Shock<br>Horror | Seeing the victim prior to impact<br>Dangerous materials<br>Helplessness of the victim<br>Train Yard incident | | | | Supportive, uninterrupted and Compassionate radio contact<br>Brief evaluation of the capacity of crew to proceed with the emergency check (body and first aid) |

Table 2

*Model Program to Prevent and Reduce the Impact of Railway fatalities, Injuries and Close Calls on Railway Workers*

| Timeline of Events | Reactions and Effects of Events | Factors Associated With the Situation | | Work Related Factors and Incident Management Factors | | Strategies to reduce the impact |
|---|---|---|---|---|---|---|
| | | Risk Factors[3] | Protective Factors[4] | Risk Factors [3] | Protective Factors [4] | |
| | | Fatality is a Suicide | | | | |
| Short Term:<br>On Site of Incident - Post Impact | Helplessness<br>Physiological reactions<br>Disbelief<br>Total exhaustion<br>Impairment of cognitive and | Being alone at the scene<br>Seeing the victim (especially if injuries)<br>Dealing with the body | Elements that emphasise the responsibility of victim (recklessness, intent) | Being treated as a suspect by police<br>Inadequate handling by supervisor on site | Compassionate handling by police and emergency services | Strictly implemented incident management protocol<br>Immediate relief of the crew and speedy evacuation<br>No participation of crew in incident management<br>Compassionate handling by supervisor<br>Limiting access to the crew from others<br>Evaluation of crew member's condition |

Table 2

*Model Program to Prevent and Reduce the Impact of Railway fatalities, Injuries and Close Calls on Railway Workers*

| Timeline of Events | Reactions and Effects of Events | Factors Associated With the Situation | | Work Related Factors and Incident Management Factors | | Strategies to reduce the impact |
|---|---|---|---|---|---|---|
| | | Risk Factors[3] | Protective Factors[4] | Risk Factors [3] | Protective Factors [4] | |
| | emotive abilities | | | | | Drive the crew home |
| Short Term: Within First Week After Incident | Anger Difficulties sleeping ADS Empathy for the victim | Having to work on the same route again Close calls and non fatal accidents | Family support Making sense of the event | Pressure to come back to work | Assurance by employer of not being guilty Receiving immediate help | Follow-up on the options available but no immediate decisions can be made within 24 hours No pressure to come back to work within 72 hours Time off 72 hours (to be flexible if needed), supervised and accompanied by regular compassionate contacts from employer and peers program |

Table 2

*Model Program to Prevent and Reduce the Impact of Railway fatalities, Injuries and Close Calls on Railway Workers*

| Timeline of Events | Reactions and Effects of Events | Factors Associated With the Situation | | Work Related Factors and Incident Management Factors | | Strategies to reduce the impact |
|---|---|---|---|---|---|---|
| | | Risk Factors[3] | Protective Factors[4] | Risk Factors [3] | Protective Factors [4] | |
| | | | | | | Evaluation of train crew's condition<br>One Briefing session (individual or collective) and planning for further assistance by the same professional if needed after evaluation. The health professional should be proactive in contacting and meeting the crew.<br>Peer support offered as soon as possible and for a long period of time (several weeks if needed)<br>Activation of support network |

Table 2

*Model Program to Prevent and Reduce the Impact of Railway fatalities, Injuries and Close Calls on Railway Workers*

| Timeline of Events | Reactions and Effects of Events | Factors Associated With the Situation | | Work Related Factors and Incident Management Factors | | Strategies to reduce the impact |
|---|---|---|---|---|---|---|
| | | Risk Factors[3] | Protective Factors[4] | Risk Factors [3] | Protective Factors [4] | |
| | | | | | | Planning return to work strategy including a supervised first trip if necessary, flexible options if possible and a post-return evaluation of the crew's condition (after a week) |
| Mid Term: Within 3 Month | PTSD<br>Anxiety<br>Flashbacks<br>Dreams<br>Hyper vigilance | | | Having to fight with employer and workers compensation Board for | | Evaluation of train crew's condition<br>Delayed time off available if needed<br>Long term professional intervention based on CBT or EMDR provided by outsourced professionals paid for by the employer |

Table 2

*Model Program to Prevent and Reduce the Impact of Railway fatalities, Injuries and Close Calls on Railway Workers*

| Timeline of Events | Reactions and Effects of Events | Factors Associated With the Situation | | Work Related Factors and Incident Management Factors | | Strategies to reduce the impact |
|---|---|---|---|---|---|---|
| | | Risk Factors[3] | Protective Factors[4] | Risk Factors [3] | Protective Factors [4] | |
| | General anxiety | | | long term support Being involved in legal procedures | | |
| Long Term | Depression Substance abuse Social withdrawal | | | | | Follow-up Evaluation of train crew's condition |

Table 2

*Model Program to Prevent and Reduce the Impact of Railway fatalities, Injuries and Close Calls on Railway Workers*

| Timeline of Events | Reactions and Effects of Events | Factors Associated With the Situation | | Work Related Factors and Incident Management Factors | | Strategies to reduce the impact |
|---|---|---|---|---|---|---|
| | | Risk Factors[3] | Protective Factors[4] | Risk Factors [3] | Protective Factors [4] | |
| | Resignation | | | | | |

# CONCLUSION

Cette étude apporte des informations supplémentaires sur les effets non diagnostiqués variés des incidents graves sur les employés ferroviaires. Les effets qui restent en dessous du seuil diagnostic et s'établissent le long d'une gradation permettent de présenter un portrait plus fidèle de la variation importante des conséquences d'être confronté à ces évènements. Nos résultats se trouvent dans la lignée des travaux présentant les effets des évènements traumatisants sur un continuum (Bonanno & Mancini, 2012; Breslau, 2009) qui permettent une analyse plus complète, au-delà des diagnostics de troubles de santé mentale.

La présence de symptômes ou effets de faible intensité, tels la perte de concentration ou la fatigue chronique augmentent ou maintiennent un état de détérioration qui à son tour augmente le risque d'erreurs professionnelles pouvant avoir des conséquences importantes dans le contexte de postes sensibles à la sécurité. Ils doivent donc être mieux pris en compte et traités dans le cadre des suivis post-incidents.

L'effet d'accumulation des incidents n'a pu être démontré dans les analyses quantitatives effectuées ici. Par contre, durant les entrevues, plusieurs ingénieurs ont indiqué que pour eux, le fait d'avoir vécu plus d'un incident avait des conséquences. Ils ont décrit un sentiment de fatigue plus intense, des difficultés de plus en plus grandes à retourner à la normale, une perception de la vie qui change, des flashbacks, une irritabilité accrue ou encore le fait de compter les jours jusqu'à la retraite. Ces effets ont été rapportés dans l'analyse qualitative préliminaire du projet (Mishara & Bardon, 2013b).

Ces observations qualitatives contrastées avec les analyses quantitatives reflètent la variété de conclusions issues de la littérature. En effet, certains auteurs ont pu

montrer que plus le nombre d'incidents antérieurs est élevé, plus le niveau de symptômes et de détresse sont élevés (Austin & Drummond, 1986; Briem et al., 2007; Karlehagen et al., 1993; Vatshelle & Moen, 1997; Yum et al., 2006). D'autres ont décrit un effet de désensibilisation venant avec le nombre d'expériences vécues, ou plus la personne vit d'incidents, moins chacun a de conséquences négatives (Farmer et al., 1992; Malt et al., 1993; Margiotta, 2000). Il est important de poursuivre l'analyse des effets cumulatifs des incidents graves sur la santé, le bien-être et le fonctionnement général des employés ferroviaires afin d'améliorer notre capacité à comprendre et évaluer les conséquences de ces incidents. Sont principalement concernés les départements de réclamation des entreprises, les cliniciens proposant des interventions de soutien et les départements de santé et sécurité au travail qui gèrent les accidents du travail et les congés maladie de longue durée.

Il est important de noter qu'une proportion non négligeable d'employés ont peu ou pas de réactions négatives après un incident grave (30% de notre échantillon). De plus, pour un tiers de plus des cas, la personne a senti qu'elle revenait à la normale en moins d'un an. La récupération semble être commune chez les employés ferroviaires après un incident grave. Cette donnée ne justifie pas l'absence d'intervention et le fait de laisser les gens revenir seuls « à la normale ». Au contraire, les personnes qui récupèrent plus vite sont celles qui ont reçu du soutien, en particulier de leur employeur. Il est important de mieux comprendre comment réduire le temps de récupération pour les employés, donc comment améliorer le soutien offert. Il est également important de définir ce qui peut être considéré comme une période acceptable de récupération après un incident grave (en termes cliniques, sociaux et professionnels) au-delà de laquelle des interventions plus intenses doivent être menées pour aider l'employé.

Il est important également de mieux faire la distinction entre le regain de l'aptitude au travail et le rétablissement suite à un évènement traumatique lié au travail. L'aptitude au travail a été définie par la capacité qu'a un individu à d'effectuer les taches associées à son travail sans risque pour lui-même, ses collègues ou le public (Serra et al., 2007). C'est un processus dynamique liant ensemble les conditions de travail et de santé. L'aptitude au travail peut se diviser en aptitude physique et psychologique. Le concept d'aptitude psychologique au travail dans le contexte ferroviaire canadien a été opérationnalisé dans le manuel des règlements médicaux (Railway Association of Canada, 2010) qui définit les conditions dans lesquelles peuvent travailler des employés affectés à des emplois importants pour la sécurité (safety critical positions) au sein de l'industrie ferroviaire. Ce sont ces règles qui président aux décisions de retour au travail des conducteurs et ingénieurs ayant un problème de santé mentale et ayant développé des difficultés diagnostiquées (ÉSPT, Stress aigu, anxiété, dépression, phobie) après un incident grave. Les variables utilisés pour établir l'aptitude au travail après un trouble de santé mentale potentiellement provoqué par un incident grave varient en partie d'un trouble à l'autre, cependant de façon générale, les employés sont évalués sur les critères suivants : altération du jugement, niveau d'attention, fatigue, récurrence de pensées intrusives, hypervigilance, problèmes affectifs, éveil ou vivacité, prévisibilité des comportements, cohérence. Un employé doit être asymptomatique sur ces critères pendant une période définie selon le trouble dont il est atteint, allant de 1 à 6 mois (Railway Association of Canada, 2010). Notre étude qualitative préliminaire des impacts des incidents graves (Mishara & Bardon, 2013b) a montré que les employés peuvent se sentir prêts à revenir longtemps avant que le règlement ne les y autorise, engendrant frustrations et sentiment d'être mal jugés par l'employeur. La présente

étude a également permis de montrer que la durée du temps pris en congé ne reflète pas non plus la durée des problèmes ressentis. Dans ce contexte, le temps de congé alloué pour récupérer peut être vécu comme une sanction et perd son rôle curatif. Il est donc important de mieux définir et évaluer le regain de l'aptitude au travail dans le contexte du retour au travail des ingénieurs et conducteurs. Cette étape de retour au travail pourrait être accélérée s'il était possible pour les employés de travailler dans des postes non critiques pour la sécurité le temps qu'ils soient prêts à revenir à leur tâche normale. Cependant, il semble que cette approche soit difficile dans le milieu ferroviaire ou les emplois et compétences requises sont très spécialisées.

La récupération (ou le rétablissement) dépasse largement le contexte de la capacité à travailler. Le concept de récupération a beaucoup été étudié dans le contexte de la psychologie positive, et de la prise de conscience de l'importance pour les patients de rebondir, grandir, changer pour le mieux dans le contexte d'un environnement qui change aussi pour mieux accepter cette personne (Onken, Craig, Ridgway, Ralph, & Cook, 2007; Starnino, 2009). Lorsque le rétablissement se produit suite à un évènement traumatisant, on parle également de croissance post-traumatique (Regel & Dyregrov, 2012) durant laquelle la personne vit une amélioration de ses relations sociales, des changements positifs dans sa perception d'elle-même et dans sa philosophie de vie. Dans un contexte de traumatisme en milieu de travail, la récupération et le rétablissement peuvent être définis comme une situation dans laquelle une personne regagne un sentiment de sécurité, de calme, d'efficacité personnelle et collective, un sentiment d'appartenance et d'espoir (Friedman & van Wyk, 2012), retrouve ses capacités fonctionnelles perdues suite à l'évènement traumatisant, gagne la capacité à utiliser des stratégies d'adaptation positives et saines, utilise son réseau social et est équipée pour faire face à des évènements

potentiellement traumatisants subséquents (Litz & Maguen, 2007). La récupération est considérée comme la réponse normale et commune à un évènement traumatisant (Freeman & Graham, 2012). Les programmes de soutien développés en entreprise visant à favoriser la récupération doivent agir sur les facteurs suivant qui sont autant d'indicateur de ce qui constitue un rétablissement en milieu de travail : moral et motivation élevés, bien être des employés augmenté, absences pour maladie moins nombreuses, récupération plus rapide, retour au travail plus rapide, diminution des réclamations en santé et sécurité au travail, amélioration du sentiment de valeur des employés, diminution du taux de roulement. La notion de récupération a également été peu étudiée dans le contexte des incidents ferroviaires, au-delà de la durée des symptômes. Il est généralement considéré que les employés sont « guéris » lorsqu'ils montrent une réduction significative des symptômes et qu'ils reviennent au travail, comme évalué par exemple dans l'étude de Cothereau (2004). Cette perception ne tient pas compte de ce que Briem et al. (2007) ont décrit comme « long term, low key trauma », qui est justement un indice majeur de non récupération. Notre étude a permis d'enrichir les connaissances sur cette question du processus de récupération par le repérage dans l'industrie ferroviaire des facteurs de risque et de protection favorisant ou limitant la récupération et décrits dans le paragraphe précédent. De plus, le protocole de prévention et de soutien que nous proposons répond également aux critères établis pour les programmes organisationnels visant à promouvoir le rétablissement (Burke, 2012).

Notre analyse de chemins (pathway analysis) a montré l'interaction de plusieurs facteurs de risque et de protection qui jouent un rôle important dans le développement des différents types de réactions post incident. Les incidents ferroviaires se produisent dans un contexte de travail ou ils ne font pas partie des

évènements attendus par les employés (comme c'est le cas pour les militaires et les premiers répondants). Notre étude a montré, qu'au-delà des facteurs individuels comme les mécanismes d'adaptation ou les réactions que la personne vit au moment de l'accident, les éléments liés au travail peuvent augmenter ou réduire drastiquement les risques de réactions négatives, comme le comportement du gestionnaire en charge de l'incident et les relations de travail. Les organisations de travail peuvent agir sur ces facteurs en changeant certaines de leurs pratiques et ainsi aider à réduire les effets négatifs à long terme et améliorer les relations de travail.

Ces analyses de chemin ont également permis d'améliorer la capacité de prédiction des réactions négatives post-incident (rôle des mécanismes d'adaptation, des réactions immédiates sur place, de la gestion d'incident, des caractéristiques des incidents, des variables pré-incidents et des facteurs liés au travail) et donc donne des pistes intéressantes pour améliorer l'évaluation du risque de difficultés rencontrées par les employés et de leurs besoins de soutien.

Parallèlement, cette meilleure connaissance des facteurs de risque et de protection permet de construire une stratégie de gestion d'incident et de soutien multi facettes, longitudinale, traversant toute l'organisation de travail et le réseau de gestion des conséquences de ces incidents (départements des réclamations des entreprises, services de santé et sécurité au travail, programmes de soutien aux employés, etc). Cette stratégie doit se faire sur l'articulation de quatre niveaux complémentaires et interdépendants.

Prévention. Les partenaires du réseau de la gestion des incidents graves peuvent travailler ensemble pour planifier des protocoles intégrés, comprenant une formation pour les gestionnaires et les employés portant sur les caractéristiques des incidents, le contenu et les procédures des protocoles de gestion d'incident, les rôles de chacun

et les ressource disponibles et les conséquences de l'utilisation de ces différentes ressources sur le retour au travail.

Gestion d'incident. Les protocoles de gestion d'incident doivent être déployés à tous les niveaux de l'organisation afin de favoriser l'appropriation et le sentiment de compétence de chacun. Ils doivent être implantés rigoureusement de façon à rendre à chacun un sentiment de contrôle et de compétence nécessaire à un retour à la normale. La gestion adéquate d'incident critiques est un moyen de réduire les effets négatifs de ces incidents sur les employés dans différentes industries (Burke, 2012).

Soutien par l'employeur. Le milieu de travail dans lequel se produit un incident grave doit agir comme une source de reconnaissance de l'impact de l'incident et de soutien. Puisque l'incident a lieu dans le cadre du travail, l'employeur est un acteur essentiel du retour à la normal et de la récupération. Ce soutien passe par un réseau de pairs aidants formés par l'employeur, la provision de services par un programme d'aide aux employés, particulièrement un briefing individuel ou de groupe dans les trois jours suivant l'incident et surtout par une attitude empathique à tous les niveaux de l'organisation.

Soins par des professionnels. Lorsque cela devient nécessaire, il est important que les employés aient accès à des ressources professionnelles compétentes et informées des enjeux liés au règlement médical, et du soutien à plus long terme, que ce soient des intervenants psychosociaux, médicaux ou en temps de repos.

Un protocole de gestion d'incident et de soutien devrait comprendre des éléments de ces quatre niveaux.

Dans le contexte de l'industrie ferroviaire, différentes instances peuvent influencer les protocoles de gestion d'incident et de soutien aux employés et jouer un rôle d'obstacle ou de facilitant dans le processus de récupération.

Le règlement médical des chemins de fer pour les postes classifiés comme essentiels pour la sécurité ferroviaire (Railway Association of Canada, 2010). Ce règlement définit les conditions médicales au sein desquelles les ingénieurs et conducteurs peuvent travailler ou pas. Il n'adresse pas spécifiquement les incidents graves ni leurs conséquences. Par contre, il décrit les conditions que doit remplir un employé qui a reçu un diagnostic de dépression, d'anxiété ou d'état de stress post traumatique pour pouvoir revenir au travail dans son poste. Selon les troubles de santé mentale diagnostiqués, l'employé doit démontrer qu'il n'a pas de symptômes pour une période allant de un à six mois. Comme nous l'avons indiqué plus haut, dans ce contexte, au lieu de protéger les employés et l'industrie, la procédure peut induire un risque.

Les médecins que les employés consultent ne sont pas toujours au courant du règlement médical et des conséquences potentielles de leurs diagnostics. Les services de santé et sécurité au travail ainsi que les associations de médecins dans les différentes provinces pourraient être associés au développement des règlements, de leur diffusion et de leur application par les médecins généralistes afin de palier aux potentiels effets pervers engendrés par leur méconnaissance.

Il peut y avoir une perception d'incompatibilité apparente entre besoins de réduire les couts dans l'industrie ferroviaire et besoins de soins et soutiens adaptés à tous niveaux de l'organisation pour réduire les conséquences négatives des incidents sur les employés. Cependant, la prévention a montré maintes fois son impact positif sur la réduction des besoins de soin. Le développement de protocoles de gestion d'incidents et de soutien aux employés dans un cadre collaboratif et accompagné de formations adéquates a un potentiel important de réduire les couts liés à l'absentéisme prolongé, aux erreurs faites par des employés en difficulté et aux

mauvaises relations de travail, d'augmenter le sentiment d'appartenance, la motivation au travail et le rendement.

Cependant, dans le contexte ferroviaire, il est vrai que nous manquons encore de données probantes pour appuyer solidement les propositions de programmes de soutien plus proactifs qui nécessitent des investissements. Il peut en effet être difficile de suggérer des investissements en formation et en temps de repos plus longs préventifs sans preuve empirique de leurs efficacité et donc du potentiel de réduction des couts à long terme. La recherche doit collaborer avec les milieux industriels pour coproduire ces connaissances et développer les programmes qui permettront de les utiliser.

1. Forces et faiblesses de l'étude

La méthodologie employée dans cette étude, basée sur des entrevues rétrospective peut induire un biais de rappel. En effet, les personnes se souviennent plus facilement de ce qui s'est produit plus récemment et cela se reflète dans le niveau de détails de la narration des différents évènements par les participants de notre étude. Malgré ce défaut, cette méthodologie est couramment utilisée dans l'étude des conséquences des incidents ferroviaires graves (Briem et al., 2007; Kim et al., 2012; Margiotta, 2000; Meier et al., 1998; Napper, 1998; Vatshelle & Moen, 1997; Yum et al., 2006), et a permis d'identifier des processus de développement des réactions traumatiques particulièrement utiles.

Également, le fait que la majorité du recrutement se soit fait avec le soutien du syndicat peut induire un biais d'auto sélection des participants. Il peut être en effet argumenté que les représentants syndicaux n'ont référé au projet que les personnes les plus durement touchées par les incidents graves afin d'influencer le portrait de

l'impact de ces incidents. Ceci est probablement en partie vrai, et cette faiblesse se retrouve dans toutes les études portant sur des enjeux importants pour un groupe particulier qui cherche à défendre ses intérêts. Cependant, lorsqu'on compare l'incidence des ÉSPT dans notre échantillon avec celle issue d'autres études d'impact sur les conducteurs de train, les données ne semblent pas indiquer une sur-représentativité de participants plus gravement touchés : 17% dans notre échantillon et entre 4% et 16% dans les études antérieures (Cothereau, 2004; Farmer et al., 1992; Limosin et al., 2006; Margiotta, 2000).

Une des forces de cette étude est d'analyser les évènements graves et leurs conséquences sur le cours de la vie des personnes interrogées. Nous avons pu recueillir des informations sur les effets que ces évènements ont eus à l'époque où ils se sont produits et sur l'évolution de ces effets dans le temps. Cette approche apporte un complément d'information par rapport aux études transversales, qui analysent l'état de santé actuel en fonction des évènements passés, comme par exemple les travaux de Margiotta (2000) ou de (Vatshelle & Moen, 1997), ou par rapport aux études analysant l'impact d'un évènement unique, comme celles de Theorell et al. (1994) ou de Cothereau et al. (2004). Elle donne une perception de l'évolution des effets dans le contexte général de la vie des personnes, et permet de confirmer l'effet potentiellement insidieux et à long terme décrit par Briem et al. (2007) et qu'il convient d'explorer plus en détails pour améliorer la capacité de récupération et construire la résilience chez les personnes ayant vécu un ou plusieurs incidents ferroviaires graves.

De la même façon, cette étude a permis d'identifier des facteurs de risque et de protection liés aux effets négatifs des incidents ferroviaires auparavant peu documentés, comme les relations de travail et la gestion d'incident. Ces facteurs sont

des cibles privilégiées de stratégies organisationnelles d'interventions. Ces données donnent un appui supplémentaire à l'argument développé dans le domaine de la prévention du traumatisme en milieu de travail qui indique que l'employeur est la clé du développement de la résilience organisationnelle et individuelle (Hughes, Kinder, & Cooper, 2012).

2. Étapes suivantes

Afin de donner suite à ce projet, plusieurs étapes sont en cours d'accomplissement ou planifiées.

La première étape vise à améliorer les connaissances du milieu ferroviaire canadien sur les enjeux liés à la prévention des réactions traumatiques et des effets négatifs des incidents graves. Dans le cadre du projet global dans lequel s'inscrit ce travail, un site web de vulgarisation a été développé afin de diffuser auprès des acteurs du milieu ferroviaire les résultats des recherches effectuées ici mais aussi dans le monde[5]. Des sections du site seront développées à partir des conclusions de cette partie de l'étude. Les résultats de l'étude ont été et continuerons d'être présentés dans divers congrès et groupes de travail liés à l'industrie ferroviaire en Amérique du nord. Des communications directes se produisent depuis début 2012 avec divers partenaires du réseau ferroviaires afin de discuter des implications de nos résultats.

Suite aux contacts directs avec VIA Rail et le Teamsters of Canada Railway Conference - TCRC, plusieurs de nos recommandations ont été adoptées et intégrées dans le nouveau protocole de gestion d'incident de VIA Rail. Nous avons profité de cette occasion pour obtenir une subvention de recherche en partenariat auprès de l'institut

[5] www.railwaysuicideprevention.com

de recherche en santé et sécurité au travail (IRSST) afin de procéder à l'évaluation des effets de ce protocole (en le comparant aux effets des protocoles de soutien en place dans les autres compagnies ferroviaires canadiennes). Ce projet débute en janvier 2014 et produira des résultats en 2016. Il permettra d'identifier certaines composantes clé des protocoles de soutien et de gestion d'incident, d'améliorer l'adaptabilité du protocole aux diverses entreprises ferroviaires au Canada et de procéder à des optimisations pour augmenter les chances d'utilisation par les entreprises.

3. Commentaires finaux

Cette étude apporte des informations tant théoriques que pratiques qui permettront d'améliorer la compréhension et la prise en charge des effets potentiellement traumatiques des incidents graves chez les conducteurs de train.

Au-delà des employés de l'industrie ferroviaire, d'autres catégories de travailleurs peuvent bénéficier des apprentissages faits ici. Les milieux de travail dont la gestion d'incidents graves n'est pas le mandat principal (contrairement aux premiers répondants ou aux militaires) ne développent pas forcément de protocoles de soutien pour leurs employés. Ils n'ont pas l'expertise ni les ressources à investir dans des protocoles complexes. Mettre en place des protocoles simples, inscrits dans les processus quotidiens de formation, de travail et de gestion, tels que décrits dans le travail que nous avons fait, peut leur offrir les moyens de répondre aux besoins ponctuels de leurs employés.

Les milieux de travail les plus susceptibles de bénéficier de ce genre de protocole sont les milieux industriels, dans lesquels les stéréotypes masculins sont forts, dans lesquels la demande d'aide et le recours à des services psychologiques ne font pas

partie des valeurs dominantes. Il faut également que les incidents graves soient probables, mais suffisamment rares pour que des procédures complexes ne soient pas requises. Certains milieux industriels, des mines et des transports peuvent être intéressés à utiliser certaines des recommandations issues des travaux faits avec l'industrie ferroviaire.

4. Références introduction et conclusion

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# ANNEXES

Annexe 1 - Grille d'entrevue

**Interview grid for railway personnel confronted with a rail-related suicide and other incidents**

## Personal details

Job status:

Seniority in the position:

Age:

Gender:

Life events impacting general / mental health status:

General health and mental health status prior to incidents:

## Historic of involvement in rail-related death incidents

Accidental deaths

Suicidal death

Work related accidents (involving colleagues)

Near death incidents

## For each incident identified

What did you see?

What did you have to do?

Who else was there? (from railway company, from the public)

How did you feel? (about the suicidal person, about the accident victim, about your role in the incident, about the event itself)

Incident management: Delay for outside intervention on site. Present actors. Your role after others arrived on site. How did you feel about the way the incident was managed?

What could have been done differently to help you?

interaction with all the different parties involved in the aftermath of the incident, including the relationship with police officers and the feeling of being questioned by police as if they were guilty of a crime rather than being supported

Aftermath of the incident: Follow-up received. Follow-up wished for (psychological, social, employment related, etc.)

Time off taken after the incident: Did you take some time off? Do you wish you could have taken some time off? What effect the time off had for you?

Changes in job / task

Specific impact of suicide versus accident for you?

Use of resources: Resources offered by the employer?, Privately contacted resources? Personal resources?

Wish for resources: Offered by employer? Privately contacted resources? Personal resources?

## Recommendations for adaptation of incident management protocols

Annexe 2 – Cahier de cotation des variables incluses dans l'étude

| Nom de variable | Brève définition initiale | cotation | Définition | Kappa |
|---|---|---|---|---|
| Relation | Relation avec l'employeur dans la période de l'incident | , 1-mauvaise (conflits, mépris), 2-(rien de spécial à signaler), 3-bonne (respect, collaboration positive) | On cote 3 quand les relations avec l'employeur sont positives et constructive. On cote 1 quand les relations sont tendues, ou l'employé trouve que l'employeur ne s'occupe pas toujours bien de ses employés, néglige le monde, l'employé n'a pas grand respect pour la compagnie. On cote 2 quand l'employé parle de son employeur et de son environnement de travail sans rien dire de spécial sur la qualité de la relation, c'est neutre, rien de spécial à signaler | 0,626 |
| évènement de vie | évènement dans la vie personnelle | 0-pas d'évènement, 1-presence d'évènement | Évènement dans la vie personnelle de l'employé qu'il soit positif ou négatif, dans la période de l'incident | 0,728 |
| Stress | niveau perçu de stress lié au travail | 1-stress élevé, pas de positif, 2-sterss élevé mais du positif, 3-peu de stress ressenti, mais beaucoup de positif | Niveau de stress en général dans le travail de la personne, tel que décrit dans lors de l'entrevue, particulièrement dans la mise en contexte initiale | 0,700 |

| Nom de variable | Brève définition initiale | cotation | Définition | Kappa |
|---|---|---|---|---|
| vulnérable | vulnérabilité perçue de la victime | 0-no, 1-oui | on cote systématiquement les enfants, perception de faiblesse ou difficultés de la personne, à se déplacer, à comprendre ce qui se passe et le danger. aussi vulnérable psychologiquement | 0,550 |
| Vu / Touché | a vu ou touché la victime après l'impact | 0-no, 1-oui | une fois que l'incident s'est produit, l'employé a vu des personnes impliquées (blessée sou non), les a touché, leur a parlé. Employé a vu le corps, a touché le corps, a vu ou touché des restes humains | 0,609 |
| pression | pression à revenir travailler | 0-no, 1-oui | a ressenti de la pression pour revenir travailler, même si a résisté et n'est pas revenu. Pression de tous ordres (employeur, argent, proches, stéréotypes) | 0,846 |
| Information victime | A eu des informations sur la / les victime(s) | 0-no, 1-oui | au-delà de ce qu'on peut voir directement (genre, tranche d'Age). Informations données par les services d'urgence, le coroner, les média, les proches... | **0,571** |
| Cherche information | A cherché des infos sur la victime | 0-no, 1-oui | A activement cherché à savoir d'où venait la victime, pourquoi elle était là et ce qui s'est passé après pour elle u ses proches | 0,638 |
| vu visage | A vu le visage ou les yeux de la victime | 0-no, 1-oui | a vu la victime de face, pas seulement une silhouette, mais tête ou visage ou yeux avant l'impact | 1,000 |
| fini voyage | a fini le voyage | 0-no, 1-oui | Après que l'Incident soit fini, l'employé a fini le voyage qu'il avait commencé | 0,559 |
| souhait time-off | a souhaité plus de time-off | 0-no, 1-oui | aurait aimé avoir du temps et n'en a pas eu et aurait aimé avoir plus de temps off après l'incident | 0,850 |

| Nom de variable | Brève définition initiale | cotation | Définition | Kappa |
|---|---|---|---|---|
| fatigue | fatigue après l'incident | 0-no, 1-oui | se sent épuisé dans les heures qui suivent l'incident (jusqu'à 48h) | 0,877 |
| victimisé | Vicitmisé par des intervenants pendant la gestin d'incident | 0-no, 1-oui | a été bousculé ou mal traité par des personnes dans le cadre de la gestion d'incident, accusé d'Avoir fait des erreurs, sentiment d'avoir été méprisé par les supérieurs, par la police, etc | 0,776 |
| Physio | Réactions physiologiques | 0-no, 1-oui | Décrit des réactions physiologiques juste après l'incident. Sueurs, cœur qui tappe, tremblements - réactions se produisant dans les heures qui suivent, jusqu'à 48h | 0,556 |
| Peur | Peur | 0-no, 1-oui | a eu peur (pour sa vie, sa sécurité, ou celle de ses collègues) ou peur générale liée à l'incident | 0,846 |
| dissociation | dissociation emotionnelle | 0-no, 1-oui | se sent déconnecté, numb, se regarde aller, comme dans un film, détaché de ce qu'il vit dans les minutes – heures qui suivent l'incident | 0,808 |
| impuissance | Impuissance | 0-no, 1-oui | Se sent impuissant à prévenir l'incident et/ou à gérer la situation après | 0,679 |
| police | interaction avec la police sur place | 1-aggravante/empiré, 2- neutre, 3-caring/positif | échanges avec les policiers de la compagnie ou les policiers locaux. Cote 1 quand critique, fâché de la façon dont on lui a parlé, s'est senti ignoré ou accusé, a dû aider la police avec la gestion d'incident et s'en ressent. Cote 3 quand a eu de bons contacts, interaction constructive, soutenu par les policiers | 0,722 |

| Nom de variable | Brève définition initiale | cotation | Définition | Kappa |
|---|---|---|---|---|
| superviseur | interaction avec superviseur | 1-aggravante/empiré, 2- neutre, 3-caring/positif | touche toutes les interactions avec les superviseurs dans le cadre de la gestion d'incident jusqu'après le retour au travail Cote 1 quand interaction négative, se sent jugé, rejet, bousculé, pressurisé, fâché de la gestion locale de l'incident. Reproche l'absence du superviseur. Cote 3 : gestion locale d'incident très positive. Quand au moins un exemple de gestion négative, on cote 1, même si les autres choses ont bien été | 0,848 |
| compagnie | Interaction avec la compagnie en général | 1-aggravante/empiré, 2- neutre, 3-caring/positif | touche tout ce qui se passe avec l'employeur dans le cadre de la gestion de l'incident | 0,500 |
| flashbacks | flashbacks | 0-no, 1-oui, | Réminiscence d'images liées aux incidents. Ça reste dans la tête, images reviennent dans différents contextes | 0,599 |
| concentration | Problèmes de concentration | 0-no, 1-oui | a des difficultés à se concentrer dans son travail et dans différents aspects de la vie quotidienne. Oublie des choses, se sent parfois comme s'il faisait les choses sans s'en souvenir, trouve plus difficile de se concentrer sur son travail (demande plus d'énergie) | 0,693 |
| fatigabilité | Fatigabilité | 0-no, 1-oui | se sent plus facilement fatigué qu'avant. Ça peut être sur une longue durée. Sent qu'il récupère moins vite, qu'il a des difficultés de repos | 1,000 |

| Nom de variable | Brève définition initiale | cotation | Définition | Kappa |
|---|---|---|---|---|
| Fonctionnement difficile | Fonctionnement general affecté | 0-no, 1-oui | sent qu'il a des difficultés à fonctionner normalement dans différents aspects de sa vie, fait des erreurs au travail, ne se sent pas lui-même comme d'habitude | 1,000 |
| « Upset » | Sentiment général difficile | 0-no, 1-oui | Sentiment assez général, pas bien décrit, je filais pas, ça allait mal, je me sentais pas bien, ça a été très dur... | 0,528 |
| hypervigilance | hypervigilance subséquente | 0-no, 1-oui | se sent hedgy au travail, alerte, voit plus les choses, remarque tous les détails | 0,815 |
| Colère | clère générale | 0-no, 1-oui | se fâche contre diverses cibles : victime, employeur, la vie en général, agressif, en colère, pète des coches sur des choses sans rapport | 0,625 |
| iritabilité | irritabilité | 0-no, 1-oui | se sent irritable dans différents contextes de la vie. Montre son irritabilité à travers ses propos, son attitude vis-à-vis des autres (employeur, proches, collègues) | 1,000 |
| rumination | rumination | 0-no, 1-oui | pense souvent à l'incident, le répète dans l'entrevue, a un scénario stéréotypé de narration de l'incident | 0,815 |
| culpabilité | se sent coupable | 0-no, 1-oui | Se sent coupable ou responsable de ce qui est arrivé. Sent qu'il aurait pu faire autrement pour empécher les chosesS'excuse de ce qu'il a fait | 1,000 |

| Nom de variable | Brève définition initiale | cotation | Définition | Kappa |
|---|---|---|---|---|
| responsabilité | attribution de faute à victiime | 0-no, 1-oui | estime que la personne est responsable de ce qui lui arrive, ce n'Est pas le hasard, pas la malchance. La personne a fait des gestes dangereux et c'est son comportement qui a mené à l'incidnet. Pas nécessairement accusatoire et vindicatif | 0,757 |
| leader | leadership et sentiment de compétence | 0-no, 1-oui | a pris les devants pour faire des choses qui ne lui étaient pas demandées dans la gestion de l'incident ou au moins s'est senti en contrôle de lui-même et de la situation à gérer. S'Est senti compétent dans sa gestion des choses | 0,739 |
| résistant | résistant | 0-no, 1-oui | sentiment plus positif, s'approchant de la croissance post traumatique. La personne intègre ça dans sa vie sans que çela donne l'impression qu'elle réprime ses sentiments et difficultés potentielles - zen - sans symptômes importants ou particuliers. Ne s'applique pas à ceux qui ont guéri | 0,181 |
| éloignement | s'éloigner pour un temps | 0-no, 1-oui | partir de la maison quelques jours, en congé ou chez des proches. Prendre physiquement ses distances avec les lieux, le travail ou le quotidien | 0,732 |
| Soutien social | utiliser du soutien social | 0-no, 1-oui | Utilise le soutien des amis, proches, collègues (hors pairs dans le PAE) | 0,875 |
| empathie | Empathie et projection | 0-no, 1-oui | exprime de l'empathie pour la personne, se projette dans cette personne ou projette certains de ses proches, s'identifie ou comprend sa souffrance | 0,770 |

| Nom de variable | Brève définition initiale | cotation | Définition | Kappa |
|---|---|---|---|---|
| évitement | évitement | 0-no, 1-oui | refuse d'aller voir la scène, évite de parler, évite de se trouver confronté à des souvenirs ou des situations qui rappellent les incidents, évite de savoir ce qui se passe, évite de se placer dans une situation d'en savir trop pour son propre confort | 0,746 |
| substance | consommation | 0-no, 1-oui | consommation est difficile à trouver parce que tabou. Parfois, on va le savoir par défaut, quand la personne dit "à l'époque, je n'avais pas cessé de boire". On peut donc coter oui tous les incidents avant cette date et non ceux d'après. | 1,000 |
| exercice | faire de l'exercice | 0-no, 1-oui | marcher, faire du sport pour décompresser | 0,938 |
| Décalage | suppression des émotion | 0-no, 1-oui | Décalage important entre le discours « Ça ne m'a rien fait » et l'intensité émotionnelle lorsqu'il raconte ou d'autres éléments qui laissent penser que le détachement est forcé et en surface seulement | 0,866 |
| debriefing | debriefing | 0-no, 1-oui | Le débriefing est effectué par un professionnel de la santé mentale, ou un intervenant désigné par le PAE afin de permettre aux employés de faire le point après l'incident - pas du soutien par les pairs et pas de la thérapie à long terme - 1 session seulement ou parfois 2 max | 1,000 |
| Assez de soins | assez de soins | 0-no, 1-oui | ressent qu'il a reçu suffisamment de soutien et soins suite à l'incident. Si la personne n'a rien eu et aurait souhaité en avoir, ça cote non. La personne qui n'en voulait pas cote oui | 0,871 |
| pairs | vu par pairs | 0-no, 1-oui | A été rencontré par un u des pairs aidants | 1,000 |
| Wcb | WCB / CSST | 0-no, 1-oui | A fait une réclamation CSST | 1,000 |

| Nom de variable | Brève définition initiale | cotation | Définition | Kappa |
|---|---|---|---|---|
| ressources personnelles | utilise ressources personnelles | 0-no, 1-oui | A fait mention d'avir eu des soins par des ressources personnelles et trouvées seul (en dehors des références de son employeur | 0,732 |
| parle | parle à autrui | 0-no, 1-oui | Parle de ce qui lui est arrivé. Utilise ce moyen pour ventiler. Parfois, ça vient plus tard, suite à la multitude d'incidents, alors ça peut être difficile de coter. On cote cette variable sur un incident quand la personne dit en parler à d'autres, que ce soit proche ou loin de l'incident lui-même | 1,000 |
| deuil | deuil | 0-no, 1-oui | Ressent un sentiment de deuil par rapport à la personne décédée | 0,647 |
| sommeil | problèmes de sommeil | 0-no, 1-oui | Vit des problèmes de sommeil en lien avec l'incident (cauchemars, insomnies, difficultés à s'endormir ou rester endormi, etc) | 0,745 |